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TEACHING PHYSICIANS AND THE MEDICARE PROGRAM

Final Report

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TEACHING PHYSICIANS AND THE MEDICARE PROGRAM

Executive Summary

Relatively little is known about teaching physicians and their costs to the Medicare program. Virtually all of the policy attention has focused on teaching hospitals which receive substantial Medicare subsidies to support graduate medical education. Teaching physicians are unique in that they can be remunerated from both Part A and Part B payments. The direct medical education (DME) payments made to the hospital provide partial salary support for the time spent teaching and supervising residents, while at the same time, fee-for-service bills for patient care may be submitted. No data exist on how much Medicare pays in total to teaching physicians.

This study attempts to document Medicare's total payments for physician services in teaching hospitals, including not only the subsidized costs of direct medical education, but also the fee-for-service bills submitted by physicians in those hospitals. To do this, we assembled data providing a complete picture of Medicare payment for a sample of hospitals, including their cost reports, MedPAR records, Part B claims, and IRIS data on their residency programs.

Data and Methods

Because we were interested in making comparisons not only between teaching and non-teaching hospitals but also among hospitals of different teaching intensity, we classified teaching hospitals into four groups: (1) academic medical centers, as defined by the Association of American Medical Colleges; (2) other Council of Teaching Hospitals (COTH) institutions; (3) other (non-COTH) teaching hospitals; and (4) non-teaching hospitals. A total of 720 hospitals were selected for analysis, including the universe of academic medical centers. Sampling weights are used in order to generalize back to all U.S. hospitals.

We obtained HCRIS cost reports for all hospitals; Medicare payment amounts for both DME and IME were calculated from these reports. We extracted all MedPAR records for calendar year 1991 for our sample hospitals and all Part B claims associated with those MedPAR records. Finally, the IRIS database was used to obtain information on the number and type of residency programs offered at each of the sample teaching hospitals.

Analytic files with merged HCRIS, Part A, Part B, and IRIS data were constructed at both the hospital and admission levels. The admission-level files allowed us to better control for within-DRG severity in explaining payment differences. We examined five medical conditions, and five surgical procedures: medically treated AMIs, pneumonia, acute stroke, bleeding ulcers, dehydration, CABG surgery, colectomy for colon cancer, total hip replacement, laminectomy, and TURP.

Descriptive Results

Table E-1 presents mean payments per admission for four different components of total Medicare payments: (1) Part B allowed charges; (2) DME payments; (3) IME payments; and (4) PPS facility payments (excluding IME amounts which we have subtracted out in order to show them separately). The final row displays the sum of all components. All payments in this tables, as well as those that follow, have been deflated for geographic price differences using the PPS Wage Index.

Part B payments per admission are significantly higher in all types of teaching hospitals, compared with non-teaching hospitals. Part B payments also are significantly greater in academic medical centers and other COTH hospitals than in other teaching hospitals. Given the availability of residents, however, we had hypothesized the opposite: Part B payments would be higher in non-teaching hospitals relative to teaching hospitals, and higher in minor teaching than in major teaching hospitals.

DME and IME payment amounts obviously increase with teaching intensity, as their amounts are calculated based (in part) on the number of residents at each institution. The absolute magnitude of the dollar amounts is striking, however. The typical academic medical center, for example, receives almost $1,000 in DME support for every Medicare admission; this is in addition to the $646 per admission paid by Part B to physicians in its faculty practice plan.

Of course, higher Part B payments in teaching hospitals may be due to a more seriously ill patient mix. Although multivariate analysis can statistically control for casemix differences, the conditions/procedures selected for the admission-level analysis are fairly homogeneous with respect to clinical severity. We found marked differences by teaching status between our five medical conditions and our five surgical procedures. Part B payments were significantly higher for medical admissions, and significantly lower for surgical cases. Larger payments for medical conditions generally resulted from more bills for routine hospital visits, and for

TABLE E-1

PAYMENT DIFFERENCES

Per Admission Payments	Academic Medical Centers	Other COTH Hospitals	Other Teaching Hospitals	Non-Teaching Hospitals
Part B	$645.61 [a,b]	$798.76 [a,b]	$449.97 [a]	$233.38
Direct Medical Education	978.48 [a,b,c]	532.80 [a,b]	278.15 [a]	0.00
Indirect Medical Education	1,932.81 [a,b,c]	863.28 [a,b]	337.55 [a]	0.00
PPS Hospital (excluding IME)	6,398.20 [a, b, c]	5,505.47 [a,b]	4,864.66 [a]	3,890.62
Total Medicare	9,955.10 [a,b,c]	7,700.32 [a,b]	5,930.33 [a]	4,124.01

(a) Significantly different from non-teaching hospitals at the 5% level.
(b) Significantly different from other teaching hospitals at the 5% level.
(c) Significantly different from other COTH hospitals at the 5% level.

NOTE: All payments have been adjusted for geographic price differences using the PPS Wage Index.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

diagnostic testing (radiology, cardiac tests, etc.). Hospital visit payments are higher in teaching hospitals, because more visits are being billed (not because fees are higher). This is surprising, as we would have expected residents to be making many of these visits. This does appear to be the case in academic medical centers (where visit bills are fewer in number, or no different, compared with non-teaching physicians), but not in the other two types of teaching hospitals. In part, this may be due to longer stays in these hospitals; there are few differences between teaching and non-teaching hospitals in the number of visits billed per day.

Part B payments for surgical cases are lower in teaching hospitals because of dramatically fewer bills for assistance at surgery and fewer bills for the surgery itself. Medicare does not reimburse for assistants-at-surgery when a resident (in the appropriate specialty) is available. In Table E-2, we see that the percent of surgical cases with Part B bills for assistance declines markedly with teaching intensity.

Regression Results

In order to fully adjust for casemix differences and other hospital characteristics, we estimated four payment regressions at both the hospital and the admission levels: (1) Part B allowed charges; (2) Part B plus DME; (3) Part B plus all graduate medical education payments (DME and IME)[1]; and (4) the total Medicare bill (PPS payments, including IME, plus Part B and DME). Although we estimated all four for completeness, the first two are the most relevant to our study of teaching physicians. While they are of interest in their own right, IME payments and PPS payments in general are not substitutes for physician payments. While some portion of IME payments is intended to cover the professional interpretation costs associated with extra testing in teaching hospitals, this portion is undoubtedly quite small, especially when compared with the costs of the tests themselves.

The impact of teaching physicians on payments was captured in two ways: (1) three dummy variables for the type of teaching hospital; and (2) interactions of the three dummies with the resident-bed ratio. The same specification was used in both the hospital-level and admission-level regressions.

[1] This model was estimated only at the hospital level.

TABLE E-2

USE OF ASSISTANTS-AT-SURGERY (percent of admissions)

	ASSISTANTS-AT-SURGERY				RESIDENCY PROGRAM IN SPECIALTY				
Surgical Procedure	Academic Medical Center	Other COTH	Other Teaching	Non-Teaching	Residency Program	Academic Medical Centers	Other COTH	Other Teaching	Non-Teaching
CABG Surgery	22% **	57% **	71% **	80%	Cardiac/ Thoracic	64%	18%	2%	0%
Colectomy for Cancer	2% **	11% **	33% **	56%	General	94%	83%	40%	0%
Total Hip Replacement	5% **	28% **	38% **	52%	Orthopedic	91%	60%	31%	0%
Laminectomy	3% **	15% **	19% **	31%	Orthopedic	88%	52%	28%	0%
TURP	0%	0%	0%	0%	Urology	87%	28%	13%	0%

**Significantly different from non-teaching hospitals at the 1% level.
*Significantly different from non-teaching hospitals at the 5% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

Part B Only

At the hospital level, holding resident availability constant, physicians in academic medical centers generate smaller Part B bills per admission than do those in non-teaching hospitals (although only significant at the 10% level). There were no differences between the other two types of teaching hospitals and the non-teaching hospitals. Resident availability was only significant for the "other" teaching hospitals, where the interaction term had the hypothesized negative sign; Part B payments fall (rise) as the relative number of residents increases (decreases).

At the admission level, holding all hospital characteristics and several severity indicators constant, Part B payments per admission were generally lower for teaching hospitals versus nonteaching hospitals for surgical procedures and some medical conditions. The statistical significance of resident availability within type of teaching hospital varied across the medical and surgical conditions.

These results appear to reflect a weighted average of payment patterns that vary by condition. Teaching physicians bill more for some types of admissions (particularly medical ones), and bill less for others (especially surgical cases), compared with non-teaching physicians. Similarly, resident availability was associated with fewer billings for some conditions, but in others had no effect. There were no consistent differences by type of teaching hospital.

Table E-3 summarizes the estimated marginal effects (in 1991 dollars) of teaching physicians. The impacts for academic medical centers, other COTH hospitals, and other teaching hospitals are based on the coefficients associated both with the respective teaching dummy variables and the interaction terms (evaluated at the mean by type of teaching hospital). The dollar impacts for the resident-bed ratio are a weighted average of the interaction term coefficients. For ease of presentation, we display only the lowest and highest values for these impacts for the five medical conditions and the five surgical procedures. Many of the condition/procedure effects are considerably larger (in absolute magnitude), compared with those calculated at the hospital level. This reflects several factors: (1) many high and low values at the admission level cancel out at the hospital level; (2) for some conditions/procedures, the proportion of admissions treated in teaching hospitals is well above the all-admission average; and (3) only 10 conditions/procedures were examined, out of the hundreds treated in any given hospital.

TABLE E-3

ESTIMATED MARGINAL EFFECTS OF TEACHING PHYSICIANS ON PAYMENTS

	PER ADMISSION	
	Part B	Part B Plus DME
Hospital Average		
Academic Medical Center	-$307	$305
Other COTH Hospitals	-98	285
Other Teaching Hospitals	-179	233
Resident-Bed Ratio	-201	129

	Part B		Part B Plus DME	
Medical Conditions	Low	High	Low	High
Academic Medical Center	-158	-15	829	1115
Other COTH Hospitals	-30	59	379	674
Other Teaching Hospitals	-56	18	193	284
Resident-Bed Ratio	-117	11	580	752
Surgical Procedures				
Academic Medical Center	-1210	153	353	1182
Other COTH Hospitals	-527	156	280	573
Other Teaching Hospitals	-473	46	-122	256
Resident-Bed Ratio	-116	819	428	2142

SOURCE: CHER calculations from regression estimates. Data are based on a sample of hospitals, 1991.

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Part B Plus DME

Because DME payments include the salaries of both residents and teaching physicians, these payments plus Part B should represent Medicare's total payment for patient care services provided by physicians. Once we include DME payments in the dependent variable, there theoretically should be no differences by type of hospital. (In fact, however, DME payments also include reimbursement for non-patient care services, such as salary support for physician administrators of residency programs.)

In the hospital-level regressions, the coefficients associated with all three teaching dummies turn positive, although only statistically significant for the "other" teaching hospitals. Patients in these hospitals "cost" the Medicare program an additional $233 per admission in total physician payments, compared with otherwise similar patients in non-teaching hospitals. All of the interaction terms also were positive, but not significant.

Adding in DME payments has a much stronger effect on the teaching variables in the admission-level regressions. The coefficients associated with both the teaching dummies and the interaction terms turn positive and significant in almost all cases. Why are these variables significant in the admission-level equations but not for the hospital overall? We suspect it may be an artifact of the conditions/procedures we have chosen, the different units of observation (admission vs. hospital), larger sample sizes at the admission level, and the additional casemix measures controlled for at the admission level.

Discussion

Although we expected to find evidence of substitution of resident-provided services for Part B services in all teaching hospitals, we found it only in the case of the minor (non-COTH) teaching hospitals. One explanation may be the relative lack of variation in resident availability in major teaching hospitals, especially among academic medical centers. (The coefficients of variation for the resident-bed ratio are 0.29, 0.69, and 1.66 for academic medical centers, other COTH, and other teaching hospitals, respectively.)

However, at the admission level, we do find more evidence of possible substitution of residents for physicians, especially for surgical procedures, in all three types of teaching hospitals. Our admission level results, while not necessarily generalizable to all admissions, are interesting in that they provide us with a much richer set of patient severity and casemix

measures compared to the hospital level analysis. Controlling for these additional patient-specific indicators within relatively homogeneous groups allows us to better isolate the impacts from teaching on Medicare payments per admission.

Including DME payments in addition to Part B eliminates the payment differential between academic medical centers and non-teaching hospitals. The differential widens and becomes statistically significant in the case of the other (non-COTH) hospitals. Part B plus DME payments are higher in these hospitals than in non-teaching hospitals, adjusting for casemix and other hospital differences. Given that some (unknown) share of DME represents payment for non-patient care, but education-related, activity, this is not surprising. What is surprising is the absence of any comparable "excess" payments for the other types of teaching hospitals. Since it is reasonable to assume that educational activity would be most intense in major teaching hospitals, these findings suggest that the "other teaching" hospitals and their medical staffs may be overpaid for physician services.

Welch (1987) has recommended that IME payments to hospitals should be based on resident-bed ratios of 0.15 and higher, arguing that true education only takes place in hospitals with at least 15 residents per 100 beds. While Welch did not consider a similar policy option with regard to DME payments, his cut-off based on a resident-bed ratio is roughly equivalent to our group of "other" teaching hospitals. This is also consistent with nonlinear specification of teaching adjustors in PPS. Future work could simulate the redistributive effects of such a DME policy on medical staffs.

1.0 BACKGROUND

1.1 Statement of the Problem

Relatively little is known about teaching physicians and their costs to the Medicare program. Virtually all of the policy attention has focused on teaching hospitals that receive substantial Medicare subsidies to support graduate medical education. Teaching physicians are unique in that they be remunerated through both Part A and Part B payments. The direct medical education (DME) payments made to the hospital provide partial salary support for the time spent teaching and supervising residents, while at the same time, fee-for-service bills for patient care may be submitted. No data exist on how much Medicare pays in toto to teaching physicians.

Teaching physicians are also unique in that they need not directly perform a service in order to submit a Part B bill. They may bill for those services provided by residents but which they (the teaching physicians) directly supervise. Some policymakers have argued that Medicare is essentially paying twice for patient care in these instances: first, through the DME salary support given to the resident, and then again through the Part B bill paid to the teaching physician. At the same time, residents may substitute for teaching physicians, permitting them to treat more patients and relieving them from on-call responsibilities.

There is only limited empirical evidence on the extent to which residents are substitutes for physicians in the provision of patient care. Drawing largely on a study of a single hospital conducted by Penchansky (1984) on the number of resident hours per case, Welch (1987) concluded that the first 10 to 15 residents per 100 beds were pure substitutes for teaching physicians. Similarly, a study of VA hospitals (whose costs include physician salaries) found that the costs of many radiological procedures were lower in those hospitals that had radiology residents (Hosek and Palmer, 1983). While intriguing, these studies are of limited generalizability for Medicare. Penchansky studied a single community hospital whose use of residents may be quite different from that of more teaching-intensive hospitals, such as academic medical centers. VA hospitals, furthermore, are quite unlike those receiving Medicare payments; among other things, there is no fee-for-service billing. (Many teaching physicians are salaried, yet still bill fee-for-service.)

Teaching physicians argue that there is little opportunity for substitution, as the supervising physician is actually with the resident while the service is provided or double-checks their work afterwards. Teaching physicians accompany residents on their rounds, for example, and do a second reading of every x-ray film read by a resident. Assistance-at-surgery is perhaps the best example of substitution, in which a resident assists the teaching physician in performing a given surgical procedure.[1] Even here, however, surgeons argue that operating room times (and hence their time inputs) are longer because of the time spent teaching residents.

This study seeks to document for the first time the total cost of physician services in teaching hospitals, including not only the subsidized costs of medical education, but also the fee-for-service bills submitted by physicians in those hospitals. To do this, we have assembled a comprehensive Medicare data base, linking cost reports, inpatient hospital claims, and physician bills at both the admission and hospital levels. First, however, we review how Medicare currently pays for graduate medical education through both its direct and indirect payments. Then we review how fee-for-service billing actually works for teaching physicians: how services are billed, fees collected, and revenues distributed to the physicians actually providing the services.

1.2 Medicare Reimbursement For Graduate Medical Education

Since its inception, Medicare has paid a portion of hospitals' net costs of graduate medical education (GME). The premise underlying the GME payment mechanism was that teaching hospitals provide an "essential service" in maintaining an adequate supply of health care personnel. Traditionally, these payments were incorporated into hospital operating costs and reimbursed on a reasonable cost basis.

Upon implementation of the prospective payment system (PPS) in 1983, however, operating costs were redefined to exclude the costs of medical education. To prevent PPS from having an adverse financial effect on teaching hospitals, Congress redesigned the payment methodology for GME. Congress assured that federal reimbursement for the costs of GME

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[1] Medicare does not reimburse assistants-at-surgery for surgical procedures in teaching hospitals that have a residency program in the relevant specialty.

would continue through Medicare's direct medical education (DME) payments and an indirect medical education (IME) adjustment. Hospitals with approved residency programs in medicine, osteopathy, dentistry and podiatry are eligible to receive DME payments. IME payments are allocated by formula to all PPS hospitals with residents on staff.

Direct Medical Education (DME)

Direct medical education costs include the salaries and benefits of interns and residents, salaries attributable to the supervisory time of teaching physicians, other teacher salaries, and overhead costs appropriately allocated to the medical education cost center. In FY92, Medicare reimbursed hospitals for approximately $1.6 billion in DME costs (Committee on Ways and Means, 1993).

DME payments to hospitals are currently based on a hospital-specific, prospective per resident amount. The DME payment is calculated by multiplying the hospital's per resident amount by its weighted number of FTE residents times the percent of inpatient days attributable to Medicare Part A beneficiaries. The cost per FTE resident is calculated using data from the hospital's FY84 cost reporting period, updated by one percent for FY86 and updated in subsequent years by the change in the consumer price index (CPI) for all urban consumers.

The number of FTE residents is weighted to reflect the length of time spent in a residency program and, for foreign medical graduates, whether they have met the appropriate criteria to qualify as a FTE resident. For an "initial" residency period, defined as the number of years required to meet board eligibility in a specialty, plus one year, and up to a limit of five years, the weighting factor is 1.0. For residents in years following the maximum five-year initial residency period, the weighting factor decreases to 0.50. It is clear from this regulation that Congress intended to limit Medicare support for longer residency programs. Resident FTEs also include those foreign medical graduates who receive adequate scores on the U.S. Medical Licensing Exam. Foreign medical graduates who fulfill the necessary requirements by the date their residency begins receive the same weighting factor as other FTEs, while those not meeting the appropriate criteria receive a weighting factor of zero.

To determine Medicare's share of DME costs, the percent of days attributable to Medicare Part A beneficiaries is calculated using the ratio of Medicare Part A inpatient days to the total inpatient days during a hospital's cost reporting period. Inpatient days include all

days reimbursable under Medicare Part A but exclude nursery days and inpatient days at skilled nursing facilities (SNFs) and intermediate care facilities.

Indirect Medical Education (IME)

IME payments are designed to cover hospitals' increased operating costs associated with offering residency programs. These costs may include higher overhead, increased volume of tests and diagnostic services, and higher staff-to-patient ratios associated with teaching facilities. The Medicare IME adjustment applies only to PPS hospitals since payments to non-PPS facilities are based on reasonable costs that implicitly include allowances for the indirect costs of medical education. In FY92, Medicare reimbursed hospitals approximately $3.6 billion for IME costs (Committee on Ways and Means, 1993).

IME costs represent additional costs due to teaching activity and are estimated statistically based on the estimated effect of teaching intensity on Medicare inpatient cost per case. Since IME costs cut across centers, they cannot be delineated using Medicare cost report data.

Medicare uses the ratio of FTE interns and residents to beds (IRB) as a proxy measure of teaching activity intensity. Since June 1991, resident counts are based on the number of FTE residents working in the hospital. Residents assigned to more than one hospital are counted as a partial FTE, as are residents who work part-time in a non-PPS area of the hospital (e.g., an excluded distinct part unit).

For discharges between October 1, 1988 and October 1, 1995, the formula used to calculate the IME adjustment factor for each hospital is: $1.89\ ((1+ IRB)^{.405} - 1))$. To determine the hospital's IME payment per case, this adjustment factor is multiplied by total DRG revenue for each case, including outlier payments but excluding disproportionate share payments. The average adjustment is applied on a curvilinear basis. As a result, increases in a hospital's IRB ratio result in less than proportional increases in IME payments.

1.3 Medicare Reimbursement For Teaching Physicians

Under Medicare, teaching and supervising physicians receive some salary support from the DME payments made to hospitals. In addition, if the physician is an 'attending physician,' he or she may also bill patients on a fee-for-service basis. Residents, on the other hand, receive full salary support through DME payments and are not allowed to bill patients separately for the health care services they provide.

In this section we provide a brief overview of the attending physician regulations and then discuss how university-based physicians differ from other teaching physicians with regard to reimbursement. Finally, since compensation incentives to individual physicians influence their propensity to bill Medicare, we discuss academic practice plan reimbursement models in detail.

1.3.1 Teaching Physicians as "Attending Physicians"

Teaching physicians are allowed to bill Medicare Part B for patient care services they provide as "attending physicians". The "attending physician" relationship must be documented in the medical record. To be considered an attending physician, the teaching physician must: (1) provide "personal and identifiable" services to the patient; (2) personally supervise interns and residents during complex or dangerous procedures; (3) assume the same responsibilities for the patients treated by residents as he or she does for other patients; and (4) personally perform certain services (e.g., examine the patient, confirm or revise diagnoses, determine the course of treatments).

The guidelines for these requirements originally were specified in Intermediary Letter Number 372 (IL-372) in 1969. In the 25 years since IL-372 was written, Congress has tried to change the methods used to reimburse teaching physicians, and HHS has tried to issue regulations implementing these changes. These attempts have been largely unsuccessful, and IL-372 remains the primary federal document describing the reimbursement guidelines. These guidelines have been difficult to operationalize and even more difficult to monitor. The General Accounting Office reviewed medical records at ten teaching hospitals and concluded that about one-half of all services were not adequately documented (GAO, 1986).

1.3.2 University Physicians vs. Other Teaching Physicians

Previous work has shown that COTH hospitals that are university-based differ markedly from other teaching hospitals (Anderson *et al.*, 1989; Welch, 1987); they treat a sicker mix of patients (as measured by Medicare's Casemix Index), they offer more "high-tech" services, and their costs are higher. Not surprisingly, how teaching physicians are compensated also differs. Physicians in academic medical centers are salaried, while those in other teaching hospitals typically are fee-for-service (just like non-teaching physicians). In all types of teaching hospitals, however, some salary support is provided for those physicians administering the residency programs.

"Other" (non-university based) teaching physicians generally bill insurers directly through their private practices. In an increasing number of cases, these physicians (like their non-teaching counterparts) have formed IPA-like entities that are responsible for billing, collections, and administration of managed care contracts. From a payment perspective, these teaching physicians do not differ from non-teaching physicians. They do, however, enjoy the benefits of having residents available in their hospitals to assume on-call responsibility nights and weekends, etc.

While physicians in academic medical centers traditionally have been salaried, those salaries increasingly are being tied to the fee-for-service revenues they generate. Little has been written about how service-based those revenues flow from the insurer back to the institution or individual physician who performed the service (or if they do at all). Because we believe understanding this revenue flow is key to understanding physician payment in teaching hospitals, we describe it at length in the following section.

1.3.3 Academic Practice Plans[2]

Typically, medical schools establish academic (or faculty) practice plans that are responsible for setting all policies with regard to billing, collection, distribution of professional fees, salary levels, incentive payments, and evaluation criteria for plan members. We

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[2] This discussion is based on a series of nine case studies we conducted during 1992-1993, including site visits to five academic medical centers. See Burge, Mitchell and Katz (1994) for more detail.

summarize below three key aspects of these plans: billing and collection, distribution of plan funds, and physician compensation.

Billing and Collection of Professional Fees

Faculty practice plan contracts stipulate that all collections for clinical activities by faculty members be assigned to the plan. Billing and collection of payments for professional services are done either with a centralized processing system for all departments or at the individual department level. For those practice plans with centralized processing, a professional billing group conducts all billing and collection functions. Generally, these groups are part of the university. Each department is assessed a charge for billing and collection services, typically a set percentage of total charges.

Distribution of Practice Plan Funds

All professional fees generated by practice plan members are placed in accounts managed by the plan. Sophisticated accounting systems are used to track collections by department and by individual physician. The pooled collections of these plans are typically subject to the following deductions. First, salaries and fringes for non-faculty plan members are deducted (e.g., administrative staff). Each department is then assessed a percentage charge on its net collections for billing and collection services. Malpractice expenses (if not paid directly by the State for plans in public medical schools) and other operating expenses are then subtracted from collections. Next, each department is assessed a "dean's tax" on its remaining net collections, ranging from 10 to 14 percent. The dean's tax is used to support a variety of activities, including facility expenses for research buildings or space and academic office space, central academic support, curriculum support, department operating deficits, house staff benefits, seed money for faculty research, etc. Some plans have a deduction for R & D or other special set asides. Physician salaries and benefits are then paid from the net collections. Residual collections in many plans are used to form a pool of funds for incentive payments.

Physician Compensation

Physician compensation schemes for academic practice plans are all basically some variant of the Blakely x-y-z Plan which consists of a base salary component (x), a variable or differential component (y), and an incentive component (z). The base salary component

(including fringes) is typically equal to the salary of a full professor in the state (for public medical schools). In private medical schools, the base salary component may be determined through negotiation after comparison and review of physician salaries at other AAMC institutions. A portion of physicians' base compensation derives from Medicare DME payments which are paid to the hospital for Medicare's share of physician costs for supervising residents and administering the medical education program. (DME payments are transferred from the hospital to the School of Medicine for this purpose.)

Incentive structures vary markedly across practice plans, and may vary by department within plan. Generally, their intent is to encourage clinical revenues, by tying compensation to productivity and collections. Models in use include the following:

- Department heads have full discretion to distribute "incentive payments" as part of the variable component from department residual earnings.
- Individual departments have the option to contribute a portion of their residual income to an incentive pool (for eventual incentive payment distribution), or to contribute all of their residual earnings to a departmental Education Fund. Under the latter option, there would be no incentive payments. State supported AMCs are less likely to use incentive payments than private AMCs.
- A plan may impose increasing marginal tax rates on the highest collection levels, but without a ceiling on earnings.
- Alternatively, incentive payments may be made under the plan, but only up to a ceiling amount. The ceilings can vary depending on physician rank.
- In the absence of a formal incentive structure, department heads may reward extraordinary performance through a negotiated variable component.

Whether or not incentive payments are made, and how they are made, will influence physicians' propensity to bill Medicare (and other insurers).

1.4 Overview of Report

Chapter 2 describes the data and methods used in our study, including the sample design. All data bases are described (HCRIS, Part A and Part B claims, and IRIS), including variable and file construction. Hospital-level analyses are presented in Chapter 3 and admission-level analyses in Chapter 4. Each of these chapters includes both descriptive and regression analyses.

2.0 DATA AND METHODS

2.1 Sample Design

Our analyses of Part B payments were conducted at both the hospital and admission levels. At the hospital level, we examined the differences in payments across academic medical centers, other COTH, other teaching and non-teaching hospitals. At the admission level, we studied five medical conditions and five surgical procedures based on primary ICD-9 diagnosis. This section provides a discussion of the sample selection for each analysis, an overview of data sources, and a brief description of file construction.

2.1.1 Hospital Sample

To compare Part B payments across hospitals, we developed a four-group categorization of teaching hospitals, using a typology similar to that used by Welch (1987) and Anderson *et al.* (1989). The four categories are:

1. Academic medical centers. These institutions are defined by the Association of American Medical Colleges (AAMC) as hospitals that are: (1) affiliated with a medical school; (2) members of the Council of Teaching Hospitals (COTH); and (3) either are under common ownership with a college of medicine, or have the majority of medical school department chairs as the hospital chiefs of service, or have the chairperson responsible for appointing the hospital chief of service.

2. Other COTH hospitals. These hospitals are members of COTH but are not considered academic medical centers by the AAMC.

3. Other teaching hospitals. These hospitals are not members of COTH but do have residents and are considered teaching hospitals for PPS payment purposes.

4. Non-teaching hospitals. These hospitals do not train residents and receive no medical education payments under PPS.

Because of the sheer claims volume (especially for Part B), we needed to select a sample of hospitals from within each type. To do so, we obtained the 1991 Provider of Service (POS) file

from HCFA which includes all hospitals receiving PPS payments in that year. We then limited the file to short-term general hospitals in the 50 states and the District of Columbia, which resulted in a universe of 5,292 hospitals for sample selection.

We then assigned each of the 5,292 hospitals to one of the four teaching categories. We received a list of the names of all academic medical centers from the AAMC, which were then matched with the provider names on our hospital file (with a 100 percent match rate). Other COTH hospitals were identified based on the COTH designation contained in the American Hospital Association files (which had been merged onto the Provider of Service file). All other teaching hospitals were those non-COTH members with at least one resident, based on HCFA's Provider of Service file. The distribution of hospitals across these four groups is displayed in Table 2-1, along with each group's share of hospital beds and Medicare discharges.

Based on the goals of our analyses, we decided to select a stratified random sample with the four hospital categories defining the strata. Within each category stratum, hospitals were sub-stratified first by census division and then by three urban-rural classes (large urban, small urban, and rural). Within these sub-strata, hospitals were sorted by MSA, number of Medicare discharges, and bedsize. Hospitals were then selected within each sub-stratum based on probability proportional to size (PPS) sampling, using Medicare discharges as the size measure. Due to their small numbers, all academic medical centers and the majority of other COTH hospitals were selected into the sample.

A total of 720 hospitals were selected: 120 academic medical centers, 120 other COTH hospitals, 240 other teaching hospitals, and 240 non-teaching hospitals. Sampling weights are used in all analyses in order to generalize back to the universe of all hospitals.

2.1.2 Admission Samples

In order to better understand the role of within-DRG severity in explaining payment differences across hospitals, we conducted admission-level analyses. We identified and examined ten groups of admissions based on ICD-9 diagnosis and procedure codes. Using diagnosis rather than

TABLE 2-1

PERCENT DISTRIBUTION OF HOSPITALS BY TEACHING STATUS

			WEIGHTED PERCENT	
	N	Percent	Beds	Medicare Discharges
Academic Medical Centers	120	2.3%	7.7%	5.6%
Other COTH Hospitals	180	3.4	10.4	10.0
Other Teaching Hospitals	889	16.8	27.9	29.0
Nonteaching Hospitals	4,103	77.5	54.0	55.4
TOTAL	**5,292**	**100%**	**100%**	**100%**

SOURCE: Medicare Provider of Service File, 1991.

DRG greatly improves the clinical homogeneity of each group (Iezzoni *et al.*, 1990). The ten groups were selected to include both medical conditions and surgical procedures, and to represent a range of physician specialties. They are:

1. Acute myocardial infarction (AMI);
2. Bacterial and pneumococcal pneumonia;
3. Cerebral infarction (acute stroke);
4. Bleeding ulcers;
5. Dehydration;
6. Coronary artery bypass graft (CABG) surgery;
7. Colectomy for colon cancer;
8. Total hip replacement;
9. Laminectomy; and
10. Transurethral prostatectomy (TURP) for benign prostatic hypertrophy.

All cases meeting the diagnostic/procedure criteria (based on MedPAR records) were extracted for each sample hospital. Table 2-2 displays the number of cases within each group by teaching status.

2.2 Cost Data

The HCFA Hospital Cost Reporting Information System (HCRIS) is a computerized abstract of the Medicare Cost Reports for each hospital. HCRIS contains information on indirect and direct medical education payments; DRG, outlier, and disproportionate share payments; number of interns and residents; utilization data; number of beds, etc. Our analyses incorporated HCRIS data on DME and IME payments, as well as department level costs, each of which is discussed in greater detail below.

In particular, we used HCRIS data for Medicare's Prospective Payment System--year 7 (PPS-7), or fiscal year 1990 for most hospitals. Although PPS-8 HCRIS data are now available, PPS-7 was the latest year of data available at the commencement of this project. (Future analyses will incorporate PPS-8 data.) PPS-7 data were available for all but four hospitals in our sample of 720. These four hospitals were all city-operated in New York City and did not report complete information because of special reporting requirements and procedures afforded to New York City hospitals. We preserved these key observations by manually

TABLE 2-2

SAMPLE SIZES FOR ADMISSION-LEVEL ANALYSES

	Academic Medical Centers	Major COTH	Other Teaching	Non-Teaching	TOTAL
Medical Conditions					
AMI	14,018	27,217	37,982	22,843	102,060
Pneumonia	5,935	9,221	14,754	11,543	41,453
Stroke	12,197	22,900	34,435	22,483	92,015
Bleeding Ulcers	6,914	10,597	15,200	9,981	42,692
Dehydration	6,081	10,655	15,744	9,939	42,419
Surgical Procedures					
CABG	20,415	29,161	29,522	7,679	86,777
Colectomy for Cancer	2,608	5,159	6,880	4,403	19,050
Total Hip Replacement	4,358	6,132	9,829	5,415	25,734
Laminectomy	2,562	4,267	6,133	2,858	15,820
TURP	6,914	17,051	25,079	18,502	67,546
TOTAL	**82,002**	**142,360**	**195,558**	**115,646**	**535,566**

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

extracting data from hardbound copies of their submitted cost reports--obtained through a special request from HCFA--onto a computer file.

2.2.1 Direct Medical Education

Direct medical education payments are reported by hospitals on Worksheet E and Supplemental Worksheet E-3, Part IV in the Medicare Cost Report (MCR).

Available Data

Our measure of total direct medical education payments was created by summing the following fields from the HCRIS Minimum Data Set (using MCR data):

- F440, total hospital medical education pass-through;
- F478A, Part A direct graduate medical education payment;
- F501A, Part B direct graduate medical education payment;
- F501B, Part B ESRD direct graduate medical education costs; and
- F413, Subprovider total.

F440 is a HCFA-created field and is found on Worksheet D in the MCR; F478A is reported on line 23 in Worksheet E, Part A; F501A is found on line 24A in Supplemental Worksheet E-3, Part IV; and F501B is reported on line 24B in Supplemental Worksheet E-3, Part IV. Also, we subtracted F413, subprovider total, reported on lines 31 and 32 in Worksheet D, Part I, from the sum of the other fields.

Estimated Values

Twenty-two hospitals (4 academic medical centers; 3 other COTH hospitals; 15 other teaching) had missing or implausible values for our total DME measure. Rather than dropping these 22 observations from our analyses, we decided to estimate replacement values. The first choice for replacing values was to use actual reported data from reporting periods before and after PPS-7 and to interpolate a value for the invalid information. Eighteen hospitals had reported DME values for PPS-8 while none had positive values for PPS-6. For the 18 hospitals reporting DME in PPS-8, we deflated the values by the urban CPI (CPI-U) for 1991 (3.1 percent)

to put the DME value into PPS-7 dollars. For the remaining four hospitals, we compared similar hospitals in terms of number of residents, bed size, region, and urban/rural status in PPS-7. We then used the total DME payment value from a similar hospital for each of the four observations as the replacement value.[1]

2.2.2 Indirect Medical Education

Two sources of indirect medical education (IME) payments were analyzed in this project. The first was the IME payment amount reported on the admission-level data in the 1991 MedPAR file. The second was the IME payment total for the hospital found on the HCRIS PPS-7 file. In theory, we should be able to create a hospital total IME payment amount from the MedPAR file by summing the IME field over all admissions which could then be reconciled with the HCRIS IME total figure. Perhaps the only differences between the total IME amount from MedPAR and HCRIS data should be the mis-matching of time periods: MedPAR data are calendar year while HCRIS data are based on fiscal year. In practice, however, we were unable to do so. The time periods could be matched, but these data didn't match for other reasons.

Available Data

We examined the MedPAR data and found that 48 percent of all admissions in academic medical centers had zero reported for the per admission IME amounts, while other COTH and other teaching hospitals showed 37 percent and 47 percent of admissions with zero IME, respectively. Reconciliation between MedPAR IME hospital totals and HCRIS IME hospital totals was, therefore, impossible using reported MedPAR data.

An alternative method for reconciling a MedPAR-generated hospital IME total with a cost report IME total is to analytically derive the IME amount per admission and then aggregate over all admissions up to the hospital level. We calculated the hospital-specific IME

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[1] We also estimated four separate regression models in our attempt to find DME replacement values. We regressed total DME against number of residents, medical education costs, intern & resident costs, operating costs, beds, CMI, Medicare days, total days, region, control status, and MSA population. In the second specification we replaced the HCRIS resident value with a weighted GME resident value from the IRIS database. The final two specifications replaced Medicare days with percent of Medicare days in the first two models. The four hospitals without PPS-8 information did not yield a plausible predicted value in any of the four models.

add-on percentage per admission as $1.89*[(1 + IRB)^{0.405} - 1)]$, where IRB is the intern/resident-to-bed ratio of the hospital. We then multiplied these percentages by the sum of total DRG payments and outlier payments per admission and summed over all admissions within each hospital. After exploring five different IRBs, we were unable to generate consistent IME totals because of unstable IRB measures (discussed below in Section 2.2.4). As a further check for consistency, we derived the total hospital IME amount by multiplying the hospital-specific IME add-on percentage by the hospital total DRG and outlier payments (i.e., $1.89*[(1 + IRB)^{0.405} - 1] * [F470 + F471]$, where F470 and F471 are DRG and DRG outlier payments, respectively, reported on Worksheet E, Part A, lines 1A and 1B). Once again, we could not reconcile the total hospital IME amounts.

As a result of the missing or invalid IME information from the MedPAR and our inability to analytically derive stable per admission (or per hospital) IME values, we decided to rely on the HCRIS hospital cost report for IME payment information for use in our analyses. Indirect medical education payments are reported by hospitals on Worksheet E, line 6A in field F477 in the HCRIS Minimum Data Set.

Estimated Values

Valid IME values were reported for all hospitals except eleven (2 academic medical centers, 4 other COTH hospitals, and 5 other teaching). As done for DME replacements, our first choice for replacing invalid IME data was to use actual reported data from reporting periods before and after PPS-7 and to interpolate the missing or invalid information. Five hospitals reported plausible IME values for PPS-8 and six had reasonable values for PPS-6; and four had reasonable values for both periods. For the four hospitals reporting valid IME in both PPS-6 and PPS-8, we interpolated a PPS-7 replacement after deflating the PPS-8 values by the PPS update factor for PPS-8 (3.4 percent) and inflating the PPS-6 values by the PPS-7 update factor (4.7 percent) to put the IME values into PPS-7 dollars. We then took an average of the two values as our replacement for these four hospitals. For the two hospitals that reported plausible PPS-6 IME payments, we inflated by the PPS-7 update factor and used these results as replacements. Similarly, we deflated the PPS-8 IME value by the PPS-8 update factor for the one hospital that reported valid PPS-8 IME payments and invalid information in PPS-6.

For the remaining four hospitals, we estimated regressions by type of teaching hospital, weighted by our sample probability weight, and calculated observation-specific predicted

values. The first regression model was specified using IME as the dependent variable and was regressed on number of residents, bed size, total admissions, region, hospital control status, MSA population, and casemix index (CMI). We then respecified this model by substituting intern/resident-to-bed ratios for number of residents and beds. We used the IRB ratio from the Provider of Service file in one model and a derived measure using HCRIS resident counts and beds in the other model. The second model using the IRB from the POS file produced the most plausible predicted values for three hospitals. For the last observation requiring replacement of its PPS-7 IME value, we compared similar hospitals in terms of bed size, urban/rural status, and region to find a replacement.

2.2.3 Department Level Costs

We created cost-to-charge measures for 15 hospital ancillary departments and for two routine cost centers from the HCRIS data base. The cost-to-charge ratios (CCRs) for the ancillary departments were created by dividing Medicare Part A inpatient hospital ancillary costs by corresponding ancillary charges reported on Supplemental Worksheet D-4 in the MCR.

For the first cost center, operating/recovery room, we summed F318, Medicare Part A inpatient ancillary operating room costs, and F319, Medicare Part A Inpatient Hospital Ancillary Costs, to create the numerator. The corresponding charge fields, F291 and F292, were also summed to form the denominator in the CCR. The operating/recovery room cost-to-charge ratio was then created as (F318, F319)/ (F291, F292). The exact algorithms used to create the ancillary department CCRs are listed below:

- Operating/Recovery Room CCR = (F318, F319)/ (F291, F292),
- Pharmacy CCR = F337/F310,
- Laboratory CCR = (F325, F327, F328, F334, F335)/ (F298, F300, F301, F307, F308),
- Radiology CCR = (F322, F323, F324)/ (F295, F296, F297),
- Medical Supplies CCR = F336/F309,

- Anesthesia CCR = F321/F294,
- Inhalation Therapy CCR = F330/F303,
- Physical Therapy CCR = (F331, F332)/ (F304, F305),
- Speech Pathology CCR = F333/F306,
- Outpatient/Emergency Room CCR = (F340, F341, F342)/ (F313, F314, F315),
- Other Ancillary Depart. CCR = (F326, F329, F338, F339)/ (F299, F302, F311, F312),
- Emergency Room CCR = F341/F314,
- Renal Dialysis CCR = F338/F311,
- Other Reimbursable Cost Center CCR = F343/F316; and
- Clinic CCR = F340/F313.

For the two routine cost centers we used cost data reported on Worksheet D-1 and revenue information from Worksheet G. Because we needed to create per diem "cost-to-charge" ratios, we also used patient day information from Worksheet S-3 . The algorithms used are:

- Routine Accommodation Per Diem
  = F452/{F516*[(F54, F56, F57, F58)/ (F67, F69, F70, F71)]}; and
- Intensive Care Unit Per Diem
  = [F453, F454, F455]/{F518*([F56, F57, F58]/ [F69, F70, F71])}.

The ancillary department CCRs and two per diem measures were merged onto our ten admission level files where we created department-level costs by multiplying charges by their respective CCRs and per diems for each admission. Hospital-level ancillary costs, by condition, were then created by aggregating over all admissions within each hospital.

2.3 Medicare Claims

For each of our 720 sample hospitals, we extracted all MedPAR records for calendar year 1991. We thus have an annual census of Medicare admissions for each hospital. Table 2-3 displays the total number of discharges by type of hospital.

We then created a "finder file" of unique HICNOs associated with sample hospital admissions. HCFA used this finder file to extract all of their 1991 Part B claims from the National Claims History. We then subsetted the Part B claims to those associated with the sample hospitals' inpatient stays and to those associated with the 30-days post discharge (based on hospital IDs and on admission and discharge dates). The resulting 66.5 million claims were then assigned a type of service (TOS) category based on the Berenson-Eggers TOS Classification developed by the Urban Institute and refined by HCFA.

2.4 IRIS

Our initial interest in the Intern and Resident Information System (IRIS) database was motivated by the inconsistency of intern/resident counts we discovered between the HCRIS and POS data bases. Accurate intern/resident counts are important for validating our measures of IME and DME and for addressing some of our major research questions about the Medicare Fee Schedule (MFS). For example, the specialty of interns and residents may be important in explaining behavioral impacts from the MFS in our multivariate regression models.

As mentioned above in Section 2.2.2, accurate intern/resident counts are also needed to create an accurate IRB measure and, hence, plausible IME amounts derived from HCFA's IME payment formula. Our hospital-level analytic file contained an IRB measure from the POS file. We also created two HCRIS-only IRB measures and two IRB measures using intern/resident counts from the IRIS file. The five IRB measures were found to be inconsistent across hospitals; as were the intern/resident counts. However, despite the unstable intern/resident counts, we pursued the analysis of IRIS data because there appears to be no benchmark for hospital-level intern/resident data and IRIS is a rare source of resident specialty information.

TABLE 2-3

SAMPLE HOSPITALS

	N	Medicare Discharges (1991)
Academic Medical Centers	120	548,528
Other COTH Hospitals	120	782,047
Other Teaching Hospitals	240	1,098,664
Nonteaching Hospitals	240	646,736
TOTAL	**720**	**3,075,975**

SOURCE: MedPAR claims, 1991.

Resident Level Data

The IRIS data base is maintained by HCFA's BDMS and contains (nearly) the universe of data at the individual intern-resident level. Some of the IRIS fields that may be particularly useful in analyzing the impact of the MFS and graduate medical education include: (1) provider number where interns and residents are assigned, (2) resident specialty type, (3) year of residency, (4) name of employer, (5) intern/resident time used for the IME count, (6) foreign graduate status, (7) PPS status of assigned hospital, and (8) intern/resident rotation information.

The IRIS database contains 419,810 intern/resident level records from provider fiscal years 1988 through 1993. A single resident may have multiple records because of training across years and rotations at different facilities. For example, if a resident had rotations in three facilities in one year and rotations at five in the next, then the file would have eight records for that individual. The number of unique interns and resident placement records within each fiscal year, summed across all years was 307,892. This total includes more than one record per individual, due to multiple placements, and therefore is not a "panel" of interns. The cohort of unique individuals over the entire file was 155,175. The distribution by residency year was as follows: year-0,[2] 11.9 percent; year-1, 26 percent; year-2, 21 percent; year-3, 18.5 percent; year-4, 11.7 percent; year-5, 6.6 percent; year-6, 2.9 percent; year-7, .9 percent; year-8, .29 percent; and year-9, .25 percent. The distribution of interns and residents by provider fiscal year is: FY 1988, 2; FY 1989, 42,870; FY 1990, 104,064; FY 1991, 99,810; FY 1992, 61,127; and FY 1993, 19. Record collection by BDMS is not complete and is still ongoing. Because only FY 1990 and 1991 appear reasonable, we focused our examination of the data on these two periods.

Resident Specialty Data

The IRIS database has 172 different residency type codes. We cross-walked these specialties to the standard HCFA specialty codes, the standard AMA specialty codes (87), and the NORC specialties (16) used for the Physicians' Practice Costs and Income Survey (PPCIS). We showed in our Interim Report a comparison of a cohort of specialties between IRIS and the

[2] Year 0 represents residents who have not completed a full year of training.

AMA survey results published in the *Journal of the American Medical Association* (JAMA). The number and percent of residents by specialty type were compared across the two sources for 1990 and 1991. For 1990, the IRIS database has a total of 104,064 while the *JAMA* survey has 82,902. The specialties compared account for 73.5 percent of the IRIS total and 79.7 percent of the *JAMA* total. While it appears that the IRIS results are inordinately large, the *JAMA* survey had an 83 percent response rate. Inflating the *JAMA* results up to a 100 percent response rate yields a total of 99,882, which is comparable to the IRIS total. For 1991, the *JAMA* total is 86,217, based on the survey response rate of 85.4 percent, and is 100,957 when we inflate up to a 100 percent response rate. The IRIS total is 99,810 and is very close to the *JAMA* figure. The decline in the IRIS total from 1990 to 1991 probably is due to ongoing BDMS data collection efforts. Nevertheless, the totals for the two years suggest that the IRIS file is reasonably accurate and complete for several types of analysis.

We utilized the specialty information from IRIS in our analyses. Specifically, we used the NORC and AMA specialty categories from IRIS and merged this information onto our hospital-level file and ten condition-specific admission-level files. This merge was straightforward for the hospital file. However, for the admission level files, we sorted by hospital provider ID and then assigned the hospital specific values of the specialty fields to each admission in that hospital. Therefore, the distribution of residents across the specialty fields are assigned to each admission within a hospital.

2.5 File Construction

Two types of files were constructed: (1) a hospital-level file; and (2) an admission-level file (or more accurately, 10 admission-level files, one for each diagnosis/procedure group). Each file included data from HCRIS, IRIS, MedPAR, and Part B. For both files, Part B claims were merged to the associated MedPAR record based on HICNO, admission date, and discharge date.

The hospital-level file included individual summary data on the 138 most common DRGs. Summary variables included length of stay, PPS payments, percent outliers, hospital costs, and Part B allowed charges by type of service, to name only a few. The same summary variables were constructed for the remaining DRGs combined. Merged to this file were hospital characteristics, all HCRIS data pertaining to DME and IME payments and interns and residents, IRIS data on residency

programs (by specialty), and the hospital's casemix index (CMI). The latter was constructed based on all 1991 admissions at a given hospital, using FY1991 DRG weights.

All admission-level files included person-level characteristics, principal and secondary diagnoses, length of stay, discharge destination, hospital costs by department, Part B allowed charges by type of service, number of visits, and specialty of attending physician, among others. All surgical files included information on the number of assistant surgeons, the Part B charges associated with those assistant surgeons, and whether the hospital offered a residency program in the relevant specialty (e.g., orthopedics in the case of hip replacement). In addition, each file also included variables specific to the individual diagnosis/procedure. Thus, the AMI file, for example, included information on whether a patient had received services such as cardiac catheterization, PTCA, pacemaker insertion, or CABG surgery.

3.0 HOSPITAL-LEVEL ANALYSIS

3.1 Introduction

In this chapter, we analyze Medicare payments to teaching and non-teaching physicians and hospitals. We begin with descriptive analysis, comparing key characteristics of the different types of hospitals, the kinds of residency programs offered by teaching hospitals, and the assignment/participation rates of medical staffs. We then compare mean Part B, DME, IME, and Medicare PPS payments per admission across the four hospital types. Multivariate regression analysis is then used to estimate the net payment differential in teaching hospitals, holding constant both casemix and hospital characteristics.

3.2 Descriptive Analysis

Hospital Characteristics and Casemix

Table 3-1 compares the four types of hospitals by several key characteristics. Not surprisingly, teaching hospitals are considerably larger than non-teaching hospitals, both in terms of bedsize and Medicare caseload. They also are almost exclusively located in urban areas, and are more likely to be receiving disproportionate share (DSH) payments under PPS. The vast majority of the academic medical centers are DSH hospitals, reflecting their inner-city location. We will see later in Chapter 4 that academic medical centers also treat a disproportionate number of black and disabled Medicare beneficiaries, presumably because of their location and because they often are public hospitals. Almost one-half of academic medical centers are government-owned (city and county), compared with less than one-third of non-teaching hospitals. By contrast, other COTH and other teaching hospitals are predominantly voluntary. Relatively few teaching hospitals are proprietary.

Not surprisingly, the Medicare Casemix Index (CMI) increases steadily with teaching intensity (moving from right to left on Table 3-1). The percent of admissions receiving PPS outlier payments also increases with teaching intensity, suggesting that teaching hospitals also may be treating a more complex, or more seriously ill, patient mix within-DRG. Finally, the percent of admissions received as transfers from another acute care hospital is higher in teaching hospitals, suggesting that more seriously ill patients, or patients requiring more high-

TABLE 3-1

HOSPITAL TYPE AND CASEMIX DIFFERENCES

	Academic Medical Centers	Other COTH Hospitals	Other Teaching Hospitals	Non-Teaching Hospitals
Hospital Characteristics				
Mean Hospital Beds	530 *	477 *	268 *	113
Mean Medicare Admissions	4,999 *	6,200 **	3,514 *	1,492
Percent of hospitals:				
Urban	95.8% *	99.3% *	89.9% *	45.7%
Disproportionate Share	91.7 *	57.5 *	52.1 *	24.8
Ownership:[a]				
Voluntary	51.7%	90.8%	77.3%	50.4%
Proprietary	1.7	2.0	6.4	19.0
Government	46.7	7.2	16.3	30.6
Casemix Variables				
Medicare Casemix Index	1.61 *	1.48 *	1.36 *	1.15
Percent of Admissions:				
Outliers	4.1% *	3.6% *	2.4% *	0.9%
Transferred In	7.6 *	5.2 *	3.5 *	1.2

(a) Ownership percentages sum to 100% by column.

*Significantly different from non-teaching hospitals at the 5% level.

SOURCE: 1991 Medicare Part A and Part B claims and HCRIS PPS-7 data for a sample of hospitals.

tech services, are being triaged to these facilities. The percent of patients received as transfers also rises with teaching intensity.

Residency Programs

As we would expect, the number of residents per hospital bed is greatest in academic medical centers and lowest in other teaching hospitals (Table 3-2). More than twice as many residents work in academic medical centers as in other COTH hospitals, and five times as many as in other teaching hospitals. There is considerable variation within hospital groups, however, especially among other teaching hospitals (as indicated by the large coefficients of variation).

How does the composition of residents change as their number increases? We can see from Table 3-2 that there is considerably more subspecialty training in academic medical centers and other COTH hospitals. The typical "other" teaching hospital offers four residency programs, of which three generally will be family practice, internal medicine, and general surgery. Academic medical centers offer an average of 27 different residency programs, spanning all of the major specialties. Other COTH hospitals generally run programs in internal medicine and general surgery, plus another ten or so specialties; unlike the academic medical centers, they do not attempt to offer everything. In particular, other COTH hospitals have fewer medical residency programs, averaging 4.6 compared with 10.8 for academic medical centers.

Assignment and Participation Rates

On the eve of Medicare Fee Schedule (MFS) implementation, some administrators of academic practices expressed concern that teaching physicians would be among the biggest losers, citing the more restrictive balance billing limits under MFS as one of the reasons.[1] Only a relatively few teaching staffs would appear to be affected by balance billing limits, however; physicians in academic medical centers and other COTH hospitals have significantly higher assignment and participation rates than those in non-teaching hospitals (see Table 3-3). Almost

[1] The other (and probably more important) reasons cited were: their relatively greater use of "overpriced" procedures, their location in urban areas, and customary charges that were higher than the area-wide historical payment amounts to be used during transition.

TABLE 3-2

NUMBER AND SCOPE OF RESIDENTS AND RESIDENCY PROGRAMS

	Academic Medical Centers	Other COTH Hospitals	Other Teaching Hospitals
Residents/per 100 Beds (Mean)	50.0	23.0	9.8
Coefficient of Variation	0.29	0.69	1.66
Mean Number of Residency Programs			
Medical	10.8	4.6	1.7
Surgical	7.8	3.8	1.4
Other	8.4	3.8	0.9
Total	27.0	12.2	4.0
PERCENT WITH PROGRAM IN:			
Medical Specialties:			
Family Practice	67.5%	49.5%	55.0%
Internal Medicine	98.3	95.8	47.6
Cardiology	77.5	42.6	5.6
Gastroenterology	70.0	34.5	4.6
Nephrology	62.5	13.1	2.3
Dermatology	76.7	15.7	4.6
Surgical Specialties:			
General Surgery	96.7	84.3	38.8
Orthopedic Surgery	95.8	53.6	22.7
Ophthalmology	85.0	39.1	13.5
Urology	86.7	28.5	11.6
Cardiac/Thoracic Surgery	55.8	14.0	1.3
Neurosurgery	78.3	15.9	6.3
Other Specialties:			
Anesthesiology	95.8	49.6	14.1
Radiology	97.5	53.6	14.2
Pathology	94.2	52.0	9.0
Psychiatry	95.0	45.4	7.5
Neurology	93.3	27.6	5.1

SOURCE: IRIS and HCRIS data for a sample of Medicare hospitals, 1991.

TABLE 3-3

ASSIGNMENT AND PARTICIPATION RATES FOR TEACHING AND NON-TEACHING PHYSICIANS
(percent of allowed charges)

	Assignment Rate	Participation Rate
Academic Medical Centers	94.8% [a]	76.8% [a]
Other COTH Hospitals	91.6 [a]	73.1 [a]
Other Teaching Hospitals	87.3	63.8
Non-teaching Hospitals	84.7	60.3

(a) Significantly different from non-teaching hospitals at the 5% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

all services in academic medical centers are taken on assignment (94.8%). These rates were calculated at the hospital level, based on inpatient charges; if teaching physicians are less likely to accept assignment in OPDs, then overall assignment rates could be lower.

Why are assignment and participation rates higher for physicians in academic medical centers and other COTH hospitals? (There is no difference between other teaching and non-teaching hospitals.) There are probably two principal reasons. First, these hospitals treat a poorer patient population, compared with other hospitals. Since poor patients will be less able to pay balance bill amounts, it makes economic sense to accept assignment and sign participation agreements. Second, in all academic medical centers and probably some other COTH hospitals, the billing is done at the department level. Each department (medicine, surgery, radiology, etc.) is a "practice", with its own Medicare provider ID submitting Part B claims and receiving payments. Therefore, Medicare participation agreements are signed at the level of the department and apply to all physicians in the department. By contrast, most of the teaching physicians in other teaching hospitals (and of course all physicians in non-teaching hospitals) are in private solo or group practice. Participation and assignment decisions in these instances are made by much smaller practice entities, and there are many more individual practices per hospital.

Payment Differences

Table 3-4 presents mean payments for four different components of Medicare's total payment per admission:

1. Part B allowed charges;
2. Direct medical education (DME) payments;
3. Indirect medical education (IME) payments; and
4. PPS hospital amounts.

This last variable includes outlier and disproportionate share payments on top of the base DRG amounts, but excludes the IME payments (which we carved out in order to analyze

TABLE 3-4

PAYMENT DIFFERENCES

Per Admission Payments	Academic Medical Centers	Other COTH Hospitals	Other Teaching Hospitals	Non-Teaching Hospitals
Part B	$645.61 [a,b]	$798.76 [a,b]	$449.97 [a]	$233.38
Direct Medical Education	978.48 [a,b,c]	532.80 [a,b]	278.15 [a]	0.00
Indirect Medical Education	1,932.81 [a,b,c]	863.28 [a,b]	337.55 [a]	0.00
PPS Hospital (excluding IME)	6,398.20 [a, b, c]	5,505.47 [a,b]	4,864.66 [a]	3,890.62
Total Medicare	9,955.10 [a,b,c]	7,700.32 [a,b]	5,930.33 [a]	4,124.01

(a) Significantly different from non-teaching hospitals at the 5% level.

(b) Significantly different from other teaching hospitals at the 5% level.

(c) Significantly different from other COTH hospitals at the 5% level.

NOTE: All payments have been adjusted for geographic price differences using the PPS Wage Index.

SOURCE: 1991 Medicare Part A and Part B claims and HCRIS PPS-7 data for a sample of hospitals.

separately).[2] The total Medicare bill is simply the sum of all four components. All payments have been deflated for geographic price differences using the PPS Wage Index.[3]

Part B payments per admission are significantly higher in all types of teaching hospitals, compared with non-teaching hospitals. Part B billings are also significantly greater in academic medical centers and other COTH hospitals than in the other teaching hospitals. This is counter to expectations; given the availability of residents, we had hypothesized that Part B payments would be higher in non-teaching hospitals relative to teaching hospitals, and higher in minor teaching than in major teaching hospitals. Of course, these payment amounts have not been adjusted for casemix differences. Greater Part B payments in teaching hospitals may be due to a more seriously ill patient mix, more surgical cases, etc. We will test this explicitly in the regression analysis below.

DME and IME payments obviously increase with teaching intensity, as their amounts are calculated based on the number of residents at each institution. The absolute magnitude of the dollar amounts is striking, however. The typical academic medical center receives almost $1,000 in DME support for every Medicare admission. Even this number pales, however, compared with IME payments. The average academic medical center receives twice as much in IME payments, almost $2,000 per admission, as it does for DME. Unlike Part B and DME payments, furthermore, these IME payments are casemix-adjusted, as they are a percentage add-on to the DRG and outlier payment amounts. The amounts received by other COTH and other teaching hospitals are smaller compared with those of academic medical centers, but still substantial.

Similarly, PPS payments also increase with teaching intensity. Since the figures shown on Table 3-4 exclude IME payments, the higher amounts in teaching hospitals are largely due to casemix (recall their higher CMIs and number of outliers), but also to their disproportionate share status.

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[2] IME payments were calculated by subtracting total IME payments reported on the hospital's cost report from the hospital's total PPS payments (summed across all MedPAR records).

[3] We chose not to use the Geographic Practice Cost Index (GPCI) as a Part B deflator for several reasons. First, the majority of teaching physicians in academic medical centers and other COTH hospitals do not incur the same types of practice costs as other physicians; in fact, many bear no costs. Second, the GPCI is somewhat controversial, especially among physicians; by contrast, the PPS Wage Index is generally accepted (and has had more opportunities to be refined and improved over time). Finally, we wanted to use the same deflator for all types of payments.

Finally, the last row in Table 3-4 calculates the total bill paid by Medicare. These figures are considerably higher than those generally seen, because most studies of hospital payments focus on PPS payments (including IME) and do not add other costs borne by the Medicare program for inpatient care: Part B physician bills and DME payments. These last two increase Medicare payments by $1,624 per stay, or 16 percent, in academic medical centers, 17 percent in other COTH hospitals ($1,332 per case), and 12 percent in other teaching hospitals ($728). By contrast, physician bills add only 6 percent, or $233 per admission, in non-teaching hospitals.

3.3 Multivariate Analysis

3.3.1 Empirical Specification and Estimation

Variable definitions and means for all variables are shown in Table 3-5.

Dependent Variables

We estimated four payment regressions: (1) Part B allowed charges; (2) Part B plus DME; (3) Part B plus all graduate medical education payments (DME and IME); and (4) the total Medicare payments (PPS payments, including IME, plus Part B and DME). All payments were deflated by the PPS Wage Index and expressed on a per admission basis. Holding casemix constant, we hypothesize that Part B bills will be lower in teaching than in non-teaching hospitals, and lower in academic medical centers than in other teaching hospitals. Because DME payments include the salaries of both residents and teaching physicians, these payments plus Part B should represent Medicare's total payment for patient care services provided by physicians. Once we include DME payments in the dependent variable as well (equation #2), there theoretically should be no differences by type of hospital. In fact, however, DME payments also include reimbursement for non-patient care services, such as salary support for physician administrators of residency programs.

Indirect medical education payments are intended to compensate hospitals for a variety of unmeasured costs believed to be associated with clinical education, some of which have nothing to do with physician services. However, IME payments also are intended to reimburse

TABLE 3-5

VARIABLE DEFINITIONS AND MEANS FOR HOSPITAL REGRESSIONS

VARIABLE NAME	VARIABLE DEFINITION	MEAN
Dependent Variables:		
B/ADM	Part B allowed charges per admission (logged)	4.379
BDME/ADM	Part B plus DME per admission (logged)	4.635
BGME/ADM	Part B plus DME and IME per admission (logged)	4.764
MCR/ADM	Total Medicare payments per admission (logged)	8.397
Independent Variables:		
AMC	Dummy variable = 1 if hospital is academic medical center.	0.023
OCOTH	Dummy variable = 1 if hospital is other COTH.	0.034
OTEACH	Dummy variable = 1 if hospital is other teaching.	0.172
AMC*IRB	Interaction of AMC and resident-bed ratio.	0.012
OCOTH*IRB	Interaction of OCOTH and resident-bed ratio.	0.008
OTEACH*IRB	Interaction of OTEACH and resident-bed ratio.	0.017
CMI	Casemix Index	1.207
OUTLIER	Proportion of admissions that are outliers.	0.013
TRANSFER	Proportion of admissions that are received in as transfers.	0.019
HMO	Proportion of admissions that are HMO enrollees.	0.007
DSH	Dummy variable = 1 if hospital receives disproportionate share payments.	0.321
URBAN	Dummy variable = 1 for urban location.	0.563
PROFIT	Dummy variable = 1 if hospital is proprietary.	0.159
GOVT	Dummy variable = 1 is government-owned (non-federal).	0.277

SOURCE: 1991 Medicare Part A and Part B claims and HCRIS PPS-7 data for a sample of hospitals.

hospitals for the additional testing performed by residents. Since the interpretation of such tests are professional services, we add in IME to the DME and Part B payments for our third measure.

Finally, we estimate a payment equation that includes all Medicare payments to both hospitals and physicians for a given admission. Because these payments are dominated by the facility (PPS) share, they are of less relevance to our study of teaching physicians. We include this last equation for completeness.

Explanatory Variables

Three dummy variables were used to capture our three types of teaching hospitals: AMC (academic medical centers), OCOTH (other COTH hospitals), and OTEACH (other teaching hospitals). Non-teaching hospitals constituted the omitted category. We estimate one set of payment regressions employing solely these dummies to capture the impacts of teaching status. We hypothesize, however, that the impact of teaching hospital type may vary as a function of the number of residents. (Recall the within-group variation in resident-bed ratios shown in Table 3-2, especially for the "other teaching" group.) In order to capture this, we interacted each teaching hospital dummy with the resident-bed ratio (IRB). Alternative specifications of the number of residents were also explored, including IRB as a linear term (not interacted) and IRB in quadratic form. Because it became clear that resident volume had a differential effect by type of teaching hospital, we used this specification for our second set of payment regression estimates.

Three variables were included to capture casemix: the hospital's Medicare Casemix Index (CMI), the proportion of admissions that were PPS outliers (OUTLIER), and the proportion of admissions that were transferred from another acute care hospital (TRANSFER). Hospitals with a higher casemix index, and greater proportions of outliers and transfers, presumably are treating a more seriously ill patient mix and physician bills are hypothesized to be higher as a result.

A small proportion of Medicare inpatients are enrolled in HMOs. Hospitals are reimbursed for patients enrolled in the older, "cost-based" HMOs just as they are for non-HMO patients (using PPS rules), but in the case of "at-risk" HMOs, hospitals are paid directly by the HMO (out of its capitated rate). Physician services, however, are capitated in both kinds of

HMOs, and no Part B bills are submitted. For this reason, we include the proportion of admissions that are HMO enrollees in our regressions.

Although hospitals treating large numbers of Medicaid and SSI patients receive additional compensation in the form of disproportionate share payments, no such adjustment is made for physician services. Because disproportionate share hospitals may treat a more complex patient mix (which would raise Part B charges), we include a dummy variable for this type of hospital (DSH). A dummy variable for hospital location (1=urban, 0=rural) is included to capture any residual geographic price differences (URBAN).

Finally, we include two dummy variables for hospital ownership, PROFIT for proprietary hospitals and GOVT for government-owned (nonfederal) hospitals. Voluntary hospitals constitute the omitted groups. We hypothesize that physicians choosing to work in public hospitals are more oriented toward charity care and hence less likely to bill, indigent patients on a fee-for-service basis. This will be particularly true for teaching physicians in academic medical centers who are salaried. The impact of proprietary hospitals on Part B billings is less clear. To the extent that physicians in these hospitals are more entrepreneurial, Part B billings should be greater. On the other hand, many proprietary hospitals are smaller, less sophisticated facilities, and their physicians may have less access to "high-tech" services, lowering Part B charges. It also should be noted that very few teaching hospitals are operated on a for-profit basis (recall Table 3-1).

Estimation

Because of the highly skewed distribution of payments, all dependent variables were estimated in logged form. Because of the large number of zero values, however, we did not log the continuous explanatory variables.

3.3.2 Pooled Regression Results

Teaching Dummies Only

Table 3-6 presents the results for our first set of regressions, including dummies for type of teaching hospital but no interactions with resident volume. We will focus first on the Part B only regression, and then compare the teaching coefficients from that regression with the subsequent payment regressions.

Teaching physicians in academic medical centers and other teaching hospitals generate significantly smaller Part B payments compared with non-teaching physicians, once we adjust for casemix differences and hospital characteristics. Part B charges for teaching physicians in other COTH hospitals were not any different from those in non-teaching hospitals.

As expected, Part B charges are higher in hospitals with relatively higher casemix indices and greater numbers of outliers. Surprisingly, a relatively greater number of transfers lowers Part B charges. This counterintuitive result apparently is due to its collinearity with CMI (r=0.63). As will be seen in Chapter 4, cases received as transfers are uniformly more expensive in the admission-level regressions.[4]

The HMO coefficient is negative and significant as expected, capturing the unbilled services provided by capitated physicians. The DSH variable is insignificant; there is no difference in Part B billing between physicians in disproportionate share hospitals and those in other hospitals. Part B payments are higher in urban areas, probably reflecting both higher fees not captured by the PPS Wage Index and practice style differences.

As hypothesized, physicians working in public hospitals generate significantly lower Part B payments, compared with those in voluntary hospitals. The coefficient on the GOVT variable implies that Part B bills per admission are 77 percent lower in government controlled hospitals compared to non-government due to this "philanthropic" mode of practice. Also, since many AMCs are public institutions, the GOVT coefficient may be capturing some of the effect of AMCs on Part B billing behavior. While physicians in proprietary hospitals also produce smaller fee-for-service bills, the coefficient on the PROFIT variable is less than one-half the size of that associated with the GOVT variable.

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[4] We re-estimated the hospital-level regressions, dropping the TRANSFER variable. None of the coefficients was affected.

TABLE 3-6

HOSPITAL REGRESSION RESULTS: TEACHING DUMMIES ONLY

	PER ADMISSION PAYMENTS (logged)			
Variable Name	Part B	Part B plus DME	Part B plus DME and IME	Total Medicare
AMC	-0.96 **	0.77 **	1.67 ***	0.30 ***
OCOTH	-0.30	0.73 **	1.33 ***	0.20 ***
OTEACH	-0.58 ***	0.59 ***	1.11 ***	0.11 ***
CMI	2.94 ***	2.59 ***	2.73 ***	0.87 ***
OUTLIER	31.06 ***	31.96 ***	30.55 ***	4.22 ***
TRANSFER	-4.47 **	-6.51 ***	-6.85 ***	-0.01
HMO	-2.92 **	-3.28 ***	-2.46 **	-1.72 ***
DSH	-0.05	0.08	0.09	0.08 ***
URBAN	0.87 ***	0.95 ***	0.94 ***	0.02
PROFIT	-0.33 **	-0.23 *	-0.23 *	0.00
GOVT	-0.77 ***	-0.53 ***	-0.49 ***	-0.03 *
Intercept	0.46	0.72 *	0.56	7.24 ***
R^2	0.44	0.56	0.62	0.78

***Significant at 1% level.
**Significant at 5% level.
*Significant at 10% level.

SOURCE: 1991 Medicare Part A and Part B claims and HCRIS PPS-7 data for a sample of hospitals.

Because the coefficients for these other explanatory variables generally remain the same across all four payment regressions, we will limit the remaining discussion of Table 3-6 to the teaching dummy variables. Once we add DME to Part B (equation #2), all three coefficients turn positive and significant. The smaller Part B bills in academic medical centers and "other teaching" hospitals are more than offset by the DME payments that these hospitals receive. Of course, some of this payment differential between teaching and non-teaching hospitals is attributable to educational activities.

The three teaching coefficients remain positive and significant in the third regression, as we would expect since IME payments are only made to teaching hospitals. Finally, total Medicare payments are significantly higher in teaching hospitals compared with non-teaching hospitals (equation #4). The size of the payment difference increases steadily with teaching intensity, furthermore, which is captured in the teaching hospital dummies.

Adjusting for Resident Availability

There is considerable variation in the relative number of residents working in teaching hospitals, even within a given type of teaching hospital. Since Part B billings and resident availability should be inversely related, we estimated a second set of regressions that included the resident-bed ratio interacted with each of the hospital dummies. These regression results are shown in Table 3-7.

Table 3-8 summarizes the marginal effects of teaching hospitals and resident availability on per admission payments. The net dollar impacts for academic medical centers, other COTH hospitals, and other teaching hospitals are based on the coefficients associated both with the respective teaching dummy variables and the interaction terms (evaluated at the mean by type of teaching hospital). The dollar impacts for resident-bed ratio are a weighted average of the interaction term coefficients, and can be interpreted as the dollar increase (decrease) associated with a one percentage point change in the number of residents per bed. Since all of these marginal effects have been calculated based on more than one coefficient, and not all coefficients are statistically significant, care must be used in interpreting them.

Once we adjust for resident availability, only the AMC dummy remains significant in the Part B regression (equation #1 in Table 3-7) and then only at the 10 percent level. Teaching physicians in academic medical centers generate smaller Part B bills than non-teaching physicians, about $300 less per admission (see Table 3-8). Within academic medical centers and

TABLE 3-7

HOSPITAL REGRESSION RESULTS: TEACHING DUMMIES PLUS RESIDENT-BED RATIO

	PER ADMISSION PAYMENTS (logged)			
Variable Name	Part B	Part B plus DME	Part B plus DME and IME	Total Medicare
AMC	-2.04 *	0.11	0.84	0.08
OCOTH	-0.00	0.61	1.01 *	0.02
OTEACH	-0.16	0.44 **	0.78 ***	0.01
AMC*IRB	2.03	1.35	1.76	0.46 *
OCOTH*IRB	-1.42	0.54	1.48	0.79 ***
OTEACH*IRB	-4.47 ***	1.64	3.45 **	0.94 ***
CMI	2.85 ***	2.61 ***	2.79 ***	0.88 ***
OUTLIER	33.17 ***	31.24 ***	28.98 ***	3.75 ***
TRANSFER	-4.54 **	-6.45 ***	-6.75 ***	0.02
HMO	-3.17 ***	-3.20 ***	-2.27 **	-1.67 ***
DSH	-0.02	0.07	0.07	0.08 ***
URBAN	0.89 ***	0.94 ***	0.92 ***	0.02
PROFIT	-0.31 **	-0.24 *	-0.24 *	0.00
GOVT	-0.71 ***	-0.56 ***	-0.54 ***	-0.04 ***
Intercept	0.50	0.71 *	0.53	7.24 ***
R^2	0.44	0.56	0.62	0.79

***Significant at 1% level.
**Significant at 5% level.
*Significant at 10% level.

SOURCE: 1991 Medicare Part A and Part B claims and HCRIS PPS-7 data for a sample of hospitals.

TABLE 3-8

ESTIMATED MARGINAL EFFECTS OF TEACHING PHYSICIANS ON PAYMENTS

	PER ADMISSION			
Teaching Hospital	Part B	Part B plus DME	Part B plus DME and IME	Total Medicare
Academic Medical Center	$-307.01	$304.87	$893.51	$1,454.75
Other COTH Hospitals	-97.82	285.14	701.51	946.53
Other Teaching Hospitals	-179.13	233.30	580.83	479.22
Resident-Bed Ratio	-201.28	128.84	355.51	934.77

SOURCE: CHER calculations from hospital-level regression estimates, based on a sample of hospitals, 1991.

within other COTH hospitals, the number of residents available has no effect on Part B billings (their interaction terms are insignificant). Within other teaching hospitals, on the other hand, resident availability has the expected inverse relationship with Part B payments (the OTEACH*IRB coefficient is negative and significant). There appears to be a clear substitution of resident-provided services for Part B billed services in these hospitals. On average, physicians in these non-COTH hospitals bill $179 less per admission than those in non-teaching hospitals.

The second regression suggests that adding in DME does make teaching physician payments more comparable to non-teaching physician payments. The coefficient associated with the AMC variable is no longer negative or significant. The coefficient associated with the OTEACH variable, on the other hand, is now positive and significant. Adjusting for resident availability (as well as casemix and all other variables in the equation), Part B plus DME payments are significantly higher in "other teaching" hospitals. Patients in these hospitals "cost" the Medicare program an additional $233 in physician payments, compared with otherwise similar patients in non-teaching hospitals.

Adding in IME has little impact on the payment differential for academic medical centers and other COTH hospitals (although the OCOTH coefficient is significant at the 10 percent level), but has a dramatic effect on the other teaching hospitals. Not only are payments higher in these hospitals compared with non-teaching hospitals, but they are higher in hospitals with higher resident/bed ratios. The typical non-COTH teaching hospital (and its medical staff) receive $581 more in physician and graduate medical education payments than a non-teaching hospital/staff, even after adjusting for casemix differences and other hospital characteristics. Of course, IME payments are based on the relative number of residents, but the interaction terms are not significant for the other two types of teaching hospitals.

The teaching impact on the total Medicare bill (equation #4 in Table 3-7) appears to be driven entirely through resident availability. Higher resident-bed ratios drive up total Medicare payments per admission in all types of teaching hospitals, although the effect is weakest in academic medical centers. Overall, a percentage point increase in the resident-bed ratio raises the average Medicare bill by almost $1,000 (see Table 3-8).

3.3.3 Conclusions

Although we have estimated four payment regressions, the first two (Part B and Part B-DME) are the most relevant to our study of teaching physicians. While they are of interest in their own right, IME payments and PPS payments in general are not substitutes for physician payments. While some portion of IME payments is intended to cover the professional interpretation costs associated with extra testing in teaching hospitals, this portion is undoubtedly quite small, especially when compared with the costs of the tests themselves.

The hospital-level regressions suggest that there are few differences in Part B billings by teaching and non-teaching physicians, after adjusting for casemix, and hospital characteristics. This was surprising, as we had expected considerably lower Part B payments to teaching physicians given resident availability. Physicians in academic medical centers did generate somewhat smaller payments, but the difference was significant only at the 10 percent level. While there was definite evidence of substitution of resident-provided services for Part B services in other teaching hospitals, there was no effect in academic medical centers or other COTH hospitals. Why not? One explanation may be the relative lack of variability in resident-bed ratios in these other types of teaching hospitals, especially in academic medical centers. Another explanation may be that some of the effect of physicians in academic medical centers and other COTH hospitals billing fewer Part B charges is captured in the GOVT variable. Also, our casemix measures may not be capturing the true patient mix severity. (We employ additional casemix measures in our admissions level regression in Chapter 4.) Finally, economic pressures on physicians in academic medical centers and other COTH hospitals to generate clinical revenue and remain competitive may offset some traditional inclinations to bill fewer Part B charges.

Redefining physician patient care payments to include DME eliminates the payment differential between academic medical centers and non-teaching hospitals as we expected. The differential widens and becomes statistically significant in the case of the other (non-COTH) teaching hospitals. Part B plus DME payments are higher in these hospitals than in non-teaching hospitals. Given that some (unknown) share of DME represents payment for non patient care, but education-related, activity, this is not surprising. What is surprising is the absence of any comparable "excess" payments for the other types of teaching hospitals. Since it

is reasonable to assume that educational activity would be most intense in major teaching hospitals, these findings suggest that the "other teaching" hospitals and their medical staffs may be overpaid for physician services.

4.0 ADMISSION-LEVEL ANALYSES

4.1 Introduction

We saw in the previous chapter that Part B payments per admission were significantly higher in all types of teaching hospitals, compared to non-teaching hospitals. Once we adjusted for casemix, these differences largely disappeared, although "other" teaching hospitals still remained more expensive. It is possible, however, that our hospital-level measures of casemix did not completely capture severity of illness within DRG. For this reason, we had selected five medical conditions and five surgical procedures for in-depth analysis at the admission-level.

We had sought to identify medical conditions based on principal ICD-9 diagnoses, rather than DRGs, in order to create more clinically homogenous groups for comparison. In the case of acute myocardial infarction (AMI), however, we found that AMI patients in teaching hospitals were more likely to be surgically treated. AMI patients admitted to teaching hospitals were significantly more likely to receive cardiac catheterization, PTCA, and CABG surgery (see Table 4-1), procedures which significantly raise Part B spending. In many cases, these patients were transferred, or otherwise triaged, to these hospitals specifically to undergo cardiovascular surgery. They are not necessarily sicker than other AMI patients; rather, they represent better surgical risks. For this reason, we decided to limit our sample to "medically treated" AMIs, those patients not receiving major surgery such as PTCA or CABG surgery. The resulting sample is equivalent to the three AMI DRGs (and include patients undergoing cardiac catheterization.)

4.2 Part B Payments

In this section, we compare Part B spending, overall and by type of service, across the four types of hospitals. The Berenson-Eggers type of service classification was used to categorize services by CPT code. All monetary variables have been adjusted for geographic price differences, using the PPS Wage Index. All tests of significance compare each of the three types of teaching hospitals with non-teaching hospitals.

TABLE 4-1

PERCENT OF ACUTE MYOCARDIAL INFARCTION PATIENTS RECEIVING CARDIOVASCULAR PROCEDURES

Procedure Group	Academic Medical Centers	Other COTH	Other Teaching	Non-Teaching
Cardiac Catheterization	46% **	39% **	36% **	21%
PTCA	17% **	14% **	12% **	6%
CABG	14% **	11% **	8% **	3%

**Significantly different from non-teaching hospitals at the 1% level.

*Significantly different from non-teaching hospitals at the 5% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

4.2.1 Medical Conditions

Our analysis of the five medical conditions indicates that inpatient Part B payments were significantly higher in teaching hospitals than in non-teaching hospitals. Academic medical centers were significantly more expensive only for AMI and stroke, the two conditions for which there is a wide array of "high-tech" diagnostic and treatment services available. Overall, Part B payments were also significantly higher in teaching hospitals for major types of service including surgery, radiology, and other tests. There were few significant differences in critical care visit billings across conditions, even though ICU use was generally greater in teaching hospitals.

Initially, we had identified two types of service where we particularly expected less Part B billing in teaching hospitals: routine hospital visits and (in the case of major surgical procedures) assistants-at-surgery. Our results indicate that Part B payments for hospital visits are significantly higher in other COTH and other teaching hospitals, however, with no difference between academic medical centers and non-teaching hospitals. Of course, payments are a combination of price and quantity, and higher payments in some types of teaching hospitals may reflect the higher fees of specialists in those hospitals. In Section 4.3 below, we will examine hospital visits, on both a per admission and daily basis.

It is possible that differences in inpatient Part B spending might be offset by spending once the patient had left the hospital. For this reason, we also summed Part B allowed charges during the 30 days following discharge. There were, however, few differences in Part B billings during the post-discharge period.

Finally, we show hospital payments per admission as a reference point. PPS (Part A facility) payments are significantly higher in teaching hospitals; this is not surprising as these payments include IME amounts.

Medically Treated AMIs

Table 4-2 compares Part B payments for medically treated AMI patients. Inpatient Part B payments are significantly higher in all types of teaching hospitals, although the absolute dollars are not large. The average AMI patient treated in an academic medical center is billed an additional $76, or less than 8 percent more than an AMI patient in a non-teaching hospital.

TABLE 4-2

EXPENDITURES FOR MEDICALLY TREATED AMIs

	Academic Medical Centers	Other COTH	Other Teaching	Non-Teaching
Inpatient Part B	$1,044 **	$1,060 **	$1,033 **	$968
Hospital Visits	265	324 **	289 **	265
Critical Care Visits	103 **	117 **	145 **	171
Consultations	64	87 **	78 **	64
Surgery	86 **	85 **	88 **	117
Assistant Surgery	0 *	1	1	2
Anesthesia	4	4	4	7
Radiology	411 **	342 **	336 **	256
Tests	80 **	72 **	63 **	57
Other	31	30	28	30
Post Discharge Part B	111	114	103 *	118
PPS Payments	6,737 **	5,459 **	4,781 **	4,255
Percent in ICU	75% **	79%	81%	80%
Length of Stay	9.4 **	9.3 **	8.4 **	7.1

**Significantly different from non-teaching hospitals at the 1% level.
*Significantly different from non-teaching hospitals at the 5% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

Critical care visits, on the other hand, are significantly lower in teaching hospitals, despite little difference in ICU use (as shown at the bottom of Table 4-2).[1] Payments for consultations were significantly higher in other COTH and other teaching hospitals, but surprisingly no different in academic medical centers.

Although restricted to medically treated cases, surgical charges for AMI patients are still incurred for diagnostic surgical procedures, such as cardiac catheterization. Part B surgical payments are significantly lower in teaching hospitals, suggesting that these procedures are performed less frequently or (more likely) are not billed.

Part B payments for radiology are significantly (and dramatically) higher in all three types of teaching hospitals. Greater spending on radiology in these settings reflects a greater use of more expensive technology, e.g. coronary angiography, echocardiography, etc. Spending on other diagnostic tests, such as ECGs, is also significantly greater in teaching settings. AMI patients hospitalized in teaching hospitals stay there much longer than those in non-teaching hospitals, a full two days more in academic medical centers and other COTH hospitals. We will see in Section 4.3 below that AMI patients in teaching hospitals (as well as those in most of the other diagnosis/procedure groups) are significantly more likely to be PPS outliers.

Pneumonia

Part B payments for patients hospitalized with bacterial and pneumococcal pneumonia are shown in Table 4-3. Our results indicate that spending is significantly greater in other COTH and other teaching hospitals, but no higher in academic medical centers compared with other teaching hospitals. Further, payment patterns for visits are not consistent by hospital type. Hospital visit payments are significantly lower in academic medical centers, while both routine and critical care visit payments are significantly higher in other COTH hospitals. Spending on consultations is consistently greater in all types of teaching hospitals.

Spending on all types of diagnostic tests and procedures is significantly greater in teaching hospitals. Pneumonia patients in all three types of teaching hospitals receive higher

[1] ICU use was constructed from MedPAR records, based on positive charges for any of the coronary care or intensive care revenue centers.

TABLE 4-3

EXPENDITURES FOR PNEUMONIA PATIENTS

	Academic Medical Centers	Other COTH	Other Teaching	Non-Teaching
Inpatient Part B	$885	$1,097 **	$938 **	$821
Hospital Visits	348 **	486 **	431	406
Critical Care Visits	89	108 *	90	78
Consultations	67 **	101 **	81 **	56
Surgery	129 **	150 **	125 *	96
Assistant Surgery	0 *	0	1	1
Anesthesia	12	14 *	11	10
Radiology	129 **	127 **	110 **	93
Tests	26 **	27 **	22 **	16
Other	84 *	84 *	67	65
Post Discharge Part B	169	200	176	192
PPS Payments	9,875 **	9,063 **	6,968 **	6,081
Percent in ICU	25% **	26% **	23% **	19%
Length of Stay	13.1 **	15.4 **	12.4 **	10.6

**Significantly different from non-teaching hospitals at the 1% level.
*Significantly different from non-teaching hospitals at the 5% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

bills for surgery, radiology (chest x-rays), and other tests. Included in the "other" category are larger payments for ventilation assistance and management.

Pneumonia patients spend significantly more time in teaching hospitals than in non-teaching hospitals and are significantly more likely to be admitted to the ICU.

Acute Stroke (Cerebral Infarction)

Part B payments for acute stroke patients are also significantly greater for those treated in all three types of teaching hospitals (Table 4-4). Physicians in other COTH and other teaching hospitals also receive significantly higher payments for routine hospital visits, but there is no difference between those in academic medical centers and non-teaching hospitals. Payments for critical care visits are lower in teaching hospitals (consistent with their lower utilization of the ICU), but payments for consultations are significantly greater.

Consistent with our AMI and pneumonia results, we see significantly greater billing by teaching physicians for surgery, radiology (head MRI and cerebral angiography), and other tests (such as non-invasive cerebrovascular tests). Also similar to previous conditions, acute stroke patients spend significantly more time in teaching versus non-teaching hospitals.

Bleeding Ulcers

Similar patterns are observed for patients admitted with bleeding ulcers (Table 4-5). Physicians in other COTH and other teaching hospitals submit significantly higher Part B bills in toto, but those in academic medical centers do not bill any more than non-teaching physicians. Similarly, while payments for routine hospital visits are greater in other COTH and other teaching hospitals, they are significantly lower in academic medical centers. Patients in all teaching hospitals incur significantly higher Part B charges for surgery, radiology, and other tests and stay in the hospital a significantly longer period of time.

Dehydration

Our final medical condition is dehydration, a principal diagnosis most often found among the frail elderly and patients admitted from nursing homes. As with similar conditions, total Part B payments is significantly greater in other COTH and other teaching hospitals but no higher in academic medical centers than in non-teaching hospitals (Table 4-6). A major source of these differences are significantly lower payments for routine hospital visits in

TABLE 4-4

EXPENDITURES FOR ACUTE STROKE PATIENTS PER ADMISSION

	Academic Medical Centers	Other COTH	Other Teaching	Non-Teaching
Inpatient Part B	$1,014 **	$1,055 **	$961 **	$865
Hospital Visits	377	448 **	403 **	380
Critical Care Visits	31 **	38 *	41	50
Consultations	102 **	137 **	116 **	94
Surgery	105 **	95 **	80 **	63
Assistant Surgery	0 *	1	1	1
Anesthesia	16 **	11 **	9	7
Radiology	292 **	239 **	232 **	203
Tests	53 **	49 **	47 **	38
Other	38 **	37 **	32 *	27
Post Discharge Part B	138	142	129	140
PPS Payments	6,842 **	5,787 **	4,852 **	4,310
Percent in ICU	22% **	18% **	22% **	26%
Length of Stay	12.9 **	13.5 **	11.5 **	9.6

**Significantly different from non-teaching hospitals at the 1% level.
*Significantly different from non-teaching hospitals at the 5% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

TABLE 4-5

EXPENDITURES FOR PATIENTS WITH BLEEDING ULCERS PER ADMISSION

	Academic Medical Centers	Other COTH	Other Teaching	Non-Teaching
Inpatient Part B	$584	$689 **	$648 **	$547
Hospital Visits	287 *	368 **	337 **	309
Critical Care Visits	11	11	14	11
Consultations	50	71 **	64 **	45
Surgery	83 *	92 **	90 **	63
Assistant Surgery	0	0	0	1
Anesthesia	12 *	12 *	12 *	8
Radiology	82 **	77 **	74 *	65
Tests	14 **	15 **	15 **	11
Other	45	43	43	34
Post Discharge Part B	232	230	214	205
PPS Payments	5,224 **	4,389 **	3,732 **	3,359
Percent in ICU	9% *	7%	7%	7%
Length of Stay	10.3 **	11.2 **	9.5 **	7.8

**Significantly different from non-teaching hospitals at the 1% level.
*Significantly different from non-teaching hospitals at the 5% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

TABLE 4-6

EXPENDITURES FOR DEHYDRATION PATIENTS PER ADMISSION

	Academic Medical Centers	Other COTH	Other Teaching	Non-Teaching
Inpatient Part B	$587	$758 **	$666 **	$582
Hospital Visits	275 **	371 **	328 **	301
Critical Care Visits	9	16	14	15
Consultations	51 *	78 **	63 **	45
Surgery	96	121 **	109	93
Assistant Surgery	0 *	0	1	1
Anesthesia	9	12 *	10	8
Radiology	79 *	88 **	79 *	70
Tests	17 **	19 **	16 **	12
Other	50	53 *	46	39
Post Discharge Part B	201	197	188	184
PPS Payments	4,808 **	4,285 **	3,539 **	3,084
Percent in ICU	9%	8%	8%	8%
Length of Stay	9.1	11.4 **	10.0	8.2

**Significantly different from non-teaching hospitals at the 1% level.
*Significantly different from non-teaching hospitals at the 5% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

academic medical centers and significantly higher payments in the other two types of teaching hospitals. Although Part B payments for consultations, radiology and tests are significantly higher in teaching hospitals, they account for a relatively small amount of the total difference between teaching and non-teaching hospitals.

While lengths of stay for the previous four conditions were consistently longer for patients admitted to teaching hospitals, there were no differences for dehydration patients treated in academic medical centers and other (non-COTH) teaching hospitals.

4.2.2 Surgical Procedures

Inpatient Part B payments were significantly lower in all three types of teaching hospitals compared with non-teaching hospitals for four of the five surgical procedures; there were no differences for laminectomy. The major reason for these lower payments are the significantly lower bills in teaching hospitals for assistants-at-surgery, for the principal surgery itself, and for related surgical procedures (such as cardiac catheterization in the case of CABG patients). Although academic medical centers and other COTHs perform a higher number of tests than non-teaching hospitals, the magnitude of the difference is not very large.

We also found that lengths of stay for patients undergoing surgical procedures are significantly higher in academic medical centers and generally higher in other COTH and other teaching hospitals than in non-teaching hospitals. Conversely, Part B bills for hospital visits were significantly lower in academic medical centers than non-teaching hospitals, but higher in other COTH and other teaching hospitals.

CABG Surgery

Unlike all of the medical conditions shown earlier, Part B payments for CABG surgery are significantly lower in teaching hospitals (Table 4-7). Physicians in academic medical centers, for example, receive payments over $1,000, or 16 percent, less than those in non-teaching hospitals. Furthermore, payments are lower in teaching hospitals for almost every type of service. The differential is particularly large for assistants-at-surgery, presumably because residents are available in many teaching hospitals; we will examine this directly in Section 4.4. Lower payments for assistants accounts for 36 percent of the total Part B differential between academic medical centers and non-teaching hospitals, for example. Lower

TABLE 4-7

EXPENDITURES FOR CABG SURGERY PATIENTS PER ADMISSION

	Academic Medical Centers	Other COTH	Other Teaching	Non-Teaching
Inpatient Part B	$5,844 **	$6,270 **	$6,254 **	$6,922
Hospital Visits	326 **	470	386 **	472
Critical Care Visits	188 **	261 **	268 **	347
Consultations	110 *	143 **	107 **	120
Surgery	3,643 **	3,576 **	3,625 **	3,891
Assistant Surgery	107 **	324 **	403 **	494
Anesthesia	722 **	766	730 *	750
Radiology	582 **	574 **	599 **	703
Tests	107 **	98 **	80	78
Other	58	57	57	67
Post Discharge Part B	129 **	139	126 **	150
PPS Payments	27,508 **	23,118 **	21,166	20,732
Percent in ICU	97%	97% **	99% **	98%
Length of Stay	16.6 **	16.4 **	14.5	14.1

**Significantly different from non-teaching hospitals at the 1% level.
*Significantly different from non-teaching hospitals at the 5% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

payments for the surgeon him/herself also contributed substantially to this differential: 23 percent. This is the result of fewer bills for additional procedures (particularly cardiac catheterization and PTCA) as well as somewhat fewer bills for the CABG surgery itself.[2]

Lower inpatient Part B payments in teaching hospitals are not offset by the longer length of stay of teaching hospital patients or by higher bills after discharge. In fact, post-discharge payments are lower, significantly so for patients treated in academic medical centers and other teaching hospitals.

Colectomy for Patients with Colon Cancer

Part B payments for colectomy patients are also significantly lower in teaching hospitals, although the absolute dollar magnitude of the differential is smaller than that observed for CABG patients (Table 4-8). Unlike the case of CABG surgery, furthermore, Part B bills are higher in teaching hospitals for some types of service (consultations, radiology and tests) and lower for others (assistance at surgery and surgery generally). The lower payments for surgery (due to fewer bills for colonoscopy and for the colectomy itself) and assistance clearly dominate, however, since overall payments are lower in teaching hospitals.

Total Hip Replacement

Similar patterns are observed for total hip replacement patients (Table 4-9), with total payments lower in teaching hospitals, primarily because of fewer bills for the principal surgery and for surgical assistance. These lower surgical payments more than offset the significantly higher payments for radiology (especially musculoskeletal x-rays) and other tests as well as the significantly longer lengths of stay that we found in academic medical centers and other COTHs. While there are no differences in critical care payments, it is noteworthy that patients undergoing hip replacement in teaching hospitals are significantly less likely to be admitted to the ICU.

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[2] Physicians in teaching hospitals, especially academic medical centers, appear to be somewhat less likely to perform cardiac catheterization during the same admission as the CABG surgery itself; a relatively smaller number of their CABG cases are in DRG 106 (coronary bypass with catheterization), compared with those in nonteaching hospitals.

TABLE 4-8

EXPENDITURES FOR COLECTOMY PATIENTS WITH COLON CANCER PER ADMISSION

	Academic Medical Centers	Other COTH	Other Teaching	Non-Teaching
Inpatient Part B	$2,590 **	$2,685 **	$2,691 *	$2,887
Hospital Visits	240 **	335	327	312
Critical Care Visits	72	59	73	70
Consultations	101	133 **	125 *	111
Surgery	1,472 **	1,499 *	1,442 **	1,598
Assistant Surgery	5 **	25 **	74 **	132
Anesthesia	343 *	329	315	324
Radiology	162 **	138 *	138 *	121
Tests	35 **	26 **	24 *	20
Other	159 **	139 **	171 **	200
Post Discharge Part B	164	160	161	197
PPS Payments	15,500 **	12,502 **	11,475 *	10,878
Percent in ICU	41%	39% **	43%	45%
Length of Stay	15.7 **	15.5 **	14.7 **	13.4

**Significantly different from non-teaching hospitals at the 1% level.
*Significantly different from non-teaching hospitals at the 5% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

TABLE 4-9

EXPENDITURES FOR TOTAL HIP REPLACEMENT PATIENTS PER ADMISSION

	Academic Medical Centers	Other COTH	Other Teaching	Non-Teaching
Inpatient Part B	$2,792 **	$2,909 *	$2,753 **	$3,032
Hospital Visits	144 **	199 *	173	174
Critical Care Visits	18	13	9	12
Consultations	70	77 **	66	65
Surgery	1,965 **	2,001	1,893 **	2,059
Assistant Surgery	16 **	94 **	130 **	194
Anesthesia	393	376 **	351 **	396
Radiology	85 **	60 *	54	52
Tests	19 **	17 **	12	12
Other	81 **	71	65	68
Post Discharge Part B	88 **	101	92 **	113
PPS Payments	11,685 **	9,540 **	8,551 *	8,337
Percent in ICU	13% *	11% **	8% **	16%
Length of Stay	11.6 **	11.4 **	10.3	10.4

**Significantly different from non-teaching hospitals at the 1% level.
*Significantly different from non-teaching hospitals at the 5% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

Laminectomy

There are almost no differences in Part B payments for laminectomy patients treated in teaching and non-teaching hospitals (Table 4-10). Physicians in academic medical centers bill almost the identical amount in total as those in non-teaching hospitals. We do observe significantly lower payment amounts for assistance at surgery for all types of teaching hospitals, however, a finding consistent with the other surgical procedures. The lack of Part B payment differences between academic medical centers and non-teaching hospitals is particularly surprising, given that the academic medical centers appear to be treating a more seriously ill group of laminectomy patients than both non-teaching hospitals and the other types of teaching hospitals. PPS payments to academic medical centers are almost 50 percent higher than those in any other type of hospital, mean lengths of stay are two days longer, and patients are twice as likely to be admitted to the ICU. There were no differences in DRG mix that might explain this, although academic medical centers did have significantly more outliers than any of the other types of hospitals.

TURP

Finally, Part B payments for TURP patients are significantly lower in teaching hospitals than in non-teaching hospitals (Table 4-11). Fewer bills for the prostate surgery itself account for most of the payment differential. Unlike the other surgical procedures, assistants are rarely needed for TURPs so lower payments for this type of service was not a factor.

4.3 Variations in Billing for Hospital Visits and Assistants-at-Surgery

We had identified two types of services that we thought would be less likely to be billed in teaching hospitals: (1) routine hospital visits; and (2) assistants-at-surgery. First, residents are responsible for the day-to-day care of their patients; although attending physicians may accompany them on their rounds, these physicians may be less likely to bill for routine hospital visits. Fewer bills may also be more likely in academic medical centers where teaching physicians are salaried. In Section 4.2, we found that payments were usually significantly higher in teaching hospitals, except in the academic medical centers where such payments were the same or even lower than those in non-teaching hospitals. Since hospital visit payments represent a mix of both the number of visits and the fee per visit, however, higher

TABLE 4-10

EXPENDITURES FOR LAMINECTOMY PATIENTS PER ADMISSION

	Academic Medical Centers	Other COTH	Other Teaching	Non-Teaching
Inpatient Part B	$3,235	$3,174	$2,957	$3,121
Hospital Visits	138	181	165	160
Critical Care Visits	42 *	17	13	16
Consultations	67	74	61	63
Surgery	2,322	2,286	2,103	2,219
Assistant Surgery	18 **	67 **	82 **	120
Anesthesia	405 **	348	336	352
Radiology	143 **	114	126	114
Tests	27 **	19 *	18	14
Other	75	70	54	62
Post Discharge Part B	86	82	78	94
PPS Payments	8,328 **	5,913 **	5,446	5,298
Percent in ICU	24% **	12%	9%	13%
Length of Stay	10.4 **	8.2	8.0	7.5

**Significantly different from non-teaching hospitals at the 1% level.
*Significantly different from non-teaching hospitals at the 5% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

TABLE 4-11

EXPENDITURES FOR TURP PATIENTS PER ADMISSION

	Academic Medical Centers	Other COTH	Other Teaching	Non-Teaching
Inpatient Part B	$1,487 **	$1,543	$1,502 **	$1,568
Hospital Visits	107 **	159 **	141 *	127
Critical Care Visits	8	9	10	12
Consultations	43	58 **	50 **	45
Surgery	967 **	975 **	960 **	1,031
Assistant Surgery	1 **	2	3	3
Anesthesia	209 **	194 *	187 **	200
Radiology	57 **	54 **	53 **	44
Tests	15 **	13 **	11	10
Other	80 **	79 **	87 **	96
Post Discharge Part B	98 *	110	104	111
PPS Payments	4,564 **	3,856 **	3,359 **	3,067
Percent in ICU	10% **	7%	7%	7%
Length of Stay	7.2 **	7.6 **	6.7 **	5.8

**Significantly different from non-teaching hospitals at the 1% level.
*Significantly different from non-teaching hospitals at the 5% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

payments do not necessarily indicate a greater propensity to bill in some teaching hospitals. In this section, we will compare the actual number of visits. Since lengths of stay generally are longer in teaching hospitals, we also will compare visits on a daily basis.

Second, in hospitals with surgical residency programs, residents, rather than billing physicians, should be more likely to serve as assistants-at-surgery. In fact, Medicare explicitly requires that a resident do so whenever available. In the previous section, we saw that Part B payments for assistants-at-surgery were consistently lower in teaching hospitals, presumably because residents were performing this function. In this section, we will explicitly examine the percent of surgical cases in which a Part B bill was submitted for assistance at surgery.

4.3.1 Routine Hospital Visits

Table 4-12 displays the number of visits per admission and per day. We show the results for medical conditions and surgical procedures separately, as routine post-operative follow-up is included in the surgeon's global fee and not billed for separately. Thus, the number of routine hospital visit bills will be smaller for surgical cases, regardless of hospital type.

There are clear differences by type of teaching hospital. Physicians in other COTH and other teaching hospitals bill for significantly more routine hospital visits in medical admissions, except AMI. Physicians in academic medical centers, on the other hand, bill for significantly fewer visits than those in non-teaching hospitals in three cases (AMI, pneumonia, and dehydration), with no differences in the remaining two.

Once we adjust for length of stay, however, many of these differences disappear. Physicians in teaching hospitals are not any more likely to bill for routine hospital visits than those in non-teaching hospitals, and often bill less. Those in academic medical centers bill significantly fewer visits in all five medical conditions.

There is a much sharper contrast between academic medical centers and other COTH hospitals in the case of surgical procedures. For four of the procedures, physicians in academic medical centers bill significantly less often, and those in other COTH hospitals significantly more often; there are no differences in the case of laminectomy. Physicians in "other" teaching hospitals tend to bill at the same rate as non-teaching physicians, after adjusting for length of stay. Academic medical center physicians are less likely to bill in all five cases, and those in

ABLE 4-12

IEAN NUMBER OF HOSPITAL VISITS PER STAY AND PER DAY

	PER STAY				PER DAY			
	Academic Medical Centers	Other COTH	Other Teaching	Non-Teaching	Academic Medical Centers	Other COTH	Other Teaching	Non-Teaching
ledical Condition								
Medically Treated AMI	7.09 **	8.96 **	7.68 **	6.43	0.79 **	0.97	0.92	0.97
Pneumonia	9.54 **	14.46 **	12.21 **	11.07	0.83 **	1.02 **	1.03 **	1.09
Stroke	10.29	13.01 **	11.35 **	10.07	0.97 **	1.16	1.14 **	1.18
Bleeding Ulcers	7.69	10.48 **	9.20 **	8.13	0.85 **	1.02 **	1.03 **	1.11
Dehydration	7.24 *	10.61 **	9.11 **	7.92	0.91 **	1.05 **	1.05 **	1.13
urgical Procedure								
CABG Surgery	8.68 **	13.44 **	10.99	11.35	0.49 **	0.77	0.70 **	0.75
Colectomy for Colon Cancer	6.67 **	10.07 *	9.75	8.75	0.38 **	0.60	0.60	0.57
Total Hip Replacement	3.95 **	5.97 **	5.12	4.84	0.32 **	0.50 **	0.47	0.43
Laminectomy	3.74	5.25	4.71	4.39	0.27 **	0.50 *	0.45	0.43
TURP	2.98 *	4.75 **	4.08 **	3.35	0.27 **	0.46 **	0.43 *	0.41

Significantly different from non-teaching hospitals at the 1% level.
Significantly different from non-teaching hospitals at the 5% level.

OURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

other COTH hospitals still bill significantly more for three of the surgical procedures. The actual magnitude of these differences is quite small, however. In the case of total hip replacement, for example, the difference between other COTH and non-teaching hospitals is about one visit per admission or 0.07 visit per day.

4.3.2 Assistants-at-Surgery

The percent of surgical cases including a Part B bill for assistant(s) are displayed in Table 4-13 for each of the five surgical procedures. Also shown in Table 4-13 are the percent of procedures performed in hospitals offering a residency program in the specialty most likely to perform that procedure. (These percentages will vary somewhat from those shown in Table 3-2, as they are based on percent of admissions, rather than percent of hospitals.)

The results are dramatic and consistent with expectations. Surgeons in all types of teaching hospitals are significantly less likely to bill for assistants-at-surgery. Presumably, a resident is assisting at surgery in all cases where such assistance is necessary. (In the case of CABG surgery, an assistant is always required.) Furthermore, the percent of cases with Part B billing declines with teaching intensity. Surgeons in academic medical centers are less likely to bill than their colleagues in other COTH hospitals, who in turn are less likely to bill than those in other teaching hospitals. Although not tested for statistical significance, the differences between types of teaching hospital are substantial.

Not surprisingly, the percent of surgeries performed in hospitals offering the relevant surgical residency also increases with teaching intensity.

4.4 Casemix Measures

This section describes the differences in casemix measures across hospital type for the five medical conditions and five surgical procedures we analyzed at the admission level. Our descriptive analysis indicates that teaching hospitals, particularly academic medical centers (AMCs), treat a patient population that has different characteristics from those treated at non-teaching hospitals. While some of our variables, such as the percent of transfer patients and the percent of PPS outlier cases, can be interpreted as proxies for casemix, other variables, such as the percent of black patients treated and the percent of patients that qualify for Medicare

TABLE 4-13

USE OF ASSISTANTS-AT-SURGERY (percent of admissions)

	ASSISTANTS-AT-SURGERY				RESIDENCY PROGRAM IN SPECIALTY				
Surgical Procedure	Academic Medical Centers	Other COTH	Other Teaching	Non-Teaching	Residency Program	Academic Medical Centers	Other COTH	Other Teaching	Non-Teaching
CABG Surgery	22% **	57% **	71% **	80%	Cardiac/ Thoracic	64%	18%	2%	0%
Colectomy for Cancer	2% **	11% **	33% **	56%	General	94%	83%	40%	0%
Total Hip Replacement	5% **	28% **	38% **	52%	Orthopedic	91%	60%	31%	0%
Laminectomy	3% **	15% **	19% **	31%	Orthopedic	88%	52%	28%	0%
TURP	0%	0%	0%	0%	Urology	87%	28%	13%	0%

**Significantly different from non-teaching hospitals at the 1% level.
*Significantly different from non-teaching hospitals at the 5% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.
IRIS data for a sample of Medicare hospitals, 1991.

due to disability or end stage renal disease (ESRD), highlight differences in patient populations at each type of hospital and may or may not directly represent differences in casemix.

The specific variables we examined are:

- *Transfers:* The transfer variable indicates the percent of admissions that were transfers into the hospital, a measure which we believe reflects the extent of inter-hospital triaging that takes place.

- *Outliers:* The percent of PPS outlier cases, which represents either day or cost outliers that received an outlier payment from Medicare.

- *Black:* The percent of black patients treated, which may reflect the predominantly urban locations of many teaching hospitals, rather than casemix per se.

- *Disabled/ESRD:* Persons who originally became entitled to Medicare due to disability or (ESRD) were analyzed as a separate group. Patients in this group have comorbidities that increase their risk of complications and adverse outcomes and make them more medically difficult to treat. This variable may overlap some with the chronic condition variables.

- *Mortality:* This variable measures mortality within 30 days from the day of admission. Interpretation of mortality rates is difficult since their relationship to casemix is indirect and not definite (e.g., sicker patients may or may not be more likely to die) and since it also may reflect quality of care.

- *Chronic conditions:* The thirteen chronic condition variables were selected based upon their prior published use in identifying more "complication prone" patients in hospitals (Iezzoni, 1994a, 1994b). Specifically, the chronic conditions represent conditions that were listed as secondary diagnoses upon admission and appear to increase patient risk for complications and/or adverse outcomes. In our analyses, patients with one or more of the chronic conditions represent a more medically complex, and perhaps sicker, admission.

4.4.1 Medical Conditions

Overall, our analysis of five medical conditions indicates that the three types of teaching hospitals treat higher percentages than non-teaching hospitals of outlier cases, transfer patients, and individuals who have qualified for Medicare due to

disability/ESRD. The higher percent of disabled/ESRD patients treated by academic medical centers may reflect this patient population's need for more specialized care or their residence in the predominantly urban locations served by most teaching hospitals. In general, these percentages increase with teaching intensity. Academic medical centers also treat a dramatically higher percent of black patients than other teaching and non-teaching hospitals. We also determined that while mortality varies among hospitals by condition, mortality rates for stroke and AMI patients are significantly lower in teaching hospitals.

Among the chronic condition variables, we found that there was considerable variation in the prevalence of the conditions. While some chronic conditions are more commonly found in teaching versus non-teaching hospitals, these variations were not consistent across the five medical conditions we analyzed. We were able to conclude, however, that academic medical centers generally treat a higher percent of patients with metastatic cancer and AIDS while non-teaching hospitals treat significantly more patients with chronic pulmonary disease and coronary artery disease. In many cases, however, the absolute magnitude of the significant differences is not meaningful.

While this analysis does not establish a link between the chronic conditions and Part B spending, we examine this relationship later in our regression analyses (see Section 4.5). Below we describe our descriptive results for each medical condition in greater detail.

Medically Treated AMIs

Casemix measures for medically treated AMIs are detailed in Table 4-14. While academic medical centers and other COTH hospitals care for a significantly higher percent of patients with congestive heart failure, non-teaching hospitals serve a greater percent of patients with chronic pulmonary and peripheral vascular diseases. In spite of differences in our various casemix measures, however, teaching hospitals have significantly lower mortality rates for AMI patients than non-teaching hospitals.

TABLE 4-14

CASEMIX MEASURES FOR MEDICALLY TREATED AMIS

	Academic Medical Centers	Other COTH	Other Teaching	Non-Teaching
Transferred In	17.4% **	10.1% **	7.1% **	2.1%
Outlier Cases	1.4% **	1.1% **	0.8% *	0.4%
Black	19.9% **	9.5% **	7.8% **	4.0%
Medicare qualification due to disability/ESRD	11.0% **	5.9%	7.1%	6.5%
30-Day Mortality Rate	19.1% **	20.7% *	21.0% *	23.0%
Percent with Chronic Condition				
Cancer	0.8%	0.8%	0.6%	0.7%
Metastatic Cancer	0.8%	0.8%	0.7%	0.6%
AIDS	0.0%	0.0%	0.0%	0.0%
Chronic Pulmonary Disease	9.6% **	10.6% **	12.0%	13.5%
Coronary Artery Disease[a]	38.4% **	36.3% **	35.1% **	29.0%
Congestive Heart Failure	43.3% **	44.5% **	40.4%	39.2%
Peripheral Vascular Disease	2.4% **	3.0% *	3.5%	3.9%
Severe Chronic Liver Disease	0.2%	0.2%	0.1%	0.1%
Diabetes with End Organ Damage	5.5%	6.1%	6.8%	6.4%
Chronic Renal Failure	2.4% *	2.3% *	2.1%	1.7%
Nutritional Deficiencies	0.4%	0.4%	0.5%	0.6%
Dementia	1.3%	1.2%	1.2%	1.2%
Functional Impairment	1.3%	1.4%	1.5%	1.8%

**Significantly different from non-teaching hospitals at the 1% level.
*Significantly different from non-teaching hospitals at the 5% level.

(a) All AMI patients have coronary artery diseases (CAD) as a principal diagnosis by definition. Presence of a secondary CAD diagnosis is not particularly meaningful; it is included here for completeness.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

Pneumonia

Table 4-15 presents the casemix measures for patients hospitalized with bacterial and pneumococcal pneumonia. The highest percent of PPS outliers can be found in other COTH facilities, while the greatest percents of transfers, black and disabled/ESRD patients are treated in academic medical centers. Unlike the AMI results, mortality for pneumonia patients does not vary consistently or significantly among the four types of hospitals.

The chronic condition results indicate again that while academic medical centers and other COTH facilities treat significantly more pneumonia patients with metastatic cancer and AIDS, non-teaching facilities treat a significantly higher percent of patients with chronic pulmonary disease, coronary artery disease, and congestive heart failure.

Acute Stroke (Cerebral Infarction)

The casemix characteristics of stroke patients are displayed on Table 4-16. Our results indicate that stroke patients in teaching facilities experience significantly lower mortality rates in these facilities than in non-teaching institutions. This result is consistent with recent work by Mitchell, *et al.* (1994) who attributed these superior outcomes to greater access to neurologists in teaching hospitals. Unlike the AMI and pneumonia patients, however, stroke patients treated in non-teaching hospitals have significantly more chronic conditions than those treated in academic medical centers. In particular, non-teaching hospitals care for patients with significantly higher presence of chronic pulmonary disease, coronary artery disease, congestive heart failure, peripheral vascular disease, and dementia.

Bleeding Ulcers

Similar patterns exist for patients admitted to the hospital with bleeding ulcers (Table 4-17). Academic medical centers receive significantly more patients as transfers, although the percent differences among the types of hospitals is very small (about 1 percent). Mortality rates among patients with bleeding ulcers do not vary significantly or consistently with teaching status of the hospital.

TABLE 4-15

CASEMIX MEASURES FOR PNEUMONIA PATIENTS

	Academic Medical Centers	Other COTH	Other Teaching	Non-Teaching
Transferred In	3.5% **	1.4% **	1.4% **	0.8%
Outlier Cases	3.9% **	5.0% **	2.9% *	1.8%
Black	25.0% **	12.9% **	9.7% **	5.1%
Medicare qualification due to disability/ESRD	22.6% **	9.5% **	9.8% **	6.5%
30-Day Mortality Rate	14.6%	16.6%	16.4%	15.4%
Percent with Chronic Condition				
Cancer	5.2%	5.1%	4.2%	4.5%
Metastatic Cancer	3.9% **	3.6% **	2.6%	2.2%
AIDS	2.9% **	0.7% **	0.4% **	0.0%
Chronic Pulmonary Disease	27.2% **	33.5% **	37.6%	39.2%
Coronary Artery Disease	7.9% *	10.0%	9.7%	9.9%
Congestive Heart Failure	19.3% *	24.8%	23.6%	22.2%
Peripheral Vascular Disease	1.0%	1.5%	1.7%	1.7%
Severe Chronic Liver Disease	0.4%	0.5%	0.4%	0.4%
Diabetes with End Organ Damage	4.0%	4.3%	4.2%	4.1%
Chronic Renal Failure	2.8%	2.7%	2.2%	2.0%
Nutritional Deficiencies	4.0%	4.7%	6.0%	5.5%
Dementia	2.7%	3.4%	3.8%	3.9%
Functional Impairment	3.4%	2.7%	2.7%	3.0%

**Significantly different from non-teaching hospitals at the 1% level.
*Significantly different from non-teaching hospitals at the 5% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

TABLE 4-16

CASEMIX MEASURES FOR STROKE PATIENTS

	Academic Medical Centers	Other COTH	Other Teaching	Non-Teaching
Transferred In	5.1% **	2.4% **	2.5% **	1.2%
Outlier Cases	4.5% **	4.4% **	2.9% **	1.9%
Black	31.1% **	17.9% **	13.8% **	8.1%
Medicare qualification due to disability/ESRD	9.3% **	4.5%	4.9% *	3.9%
30-Day Mortality Rate	10.8% **	12.6% **	13.7% *	15.2%
Percent with Chronic Condition				
Cancer	1.0%	1.1%	1.1%	1.0%
Metastatic Cancer	1.4%	1.5%	1.3%	1.2%
AIDS	0.0% *	0.0%	0.0%	0.0%
Chronic Pulmonary Disease	6.0% **	7.3% **	8.8%	9.5%
Coronary Artery Disease	12.5% **	14.6%	14.2%	15.1%
Congestive Heart Failure	10.3% *	11.9%	11.8%	11.7%
Peripheral Vascular Disease	3.1% **	3.5% *	4.0%	4.4%
Severe Chronic Liver Disease	0.2%	0.2%	0.2%	0.2%
Diabetes with End Organ Damage	5.9%	6.5%	6.8%	6.6%
Chronic Renal Failure	1.5%	1.5%	1.4%	1.2%
Nutritional Deficiencies	1.3%	1.4%	1.9%	1.6%
Dementia	3.2% *	3.7%	3.9%	4.1%
Functional Impairment	21.9%	24.1%	23.4%	23.0%

**Significantly different from non-teaching hospitals at the 1% level.
*Significantly different from non-teaching hospitals at the 5% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

TABLE 4-17

CASEMIX MEASURES FOR PATIENTS WITH BLEEDING ULCERS

	Academic Medical Centers	Other COTH	Other Teaching	Non-Teaching
Transferred In	1.6% **	0.7%	0.6%	0.5%
Outlier Cases	2.4% **	2.6% **	1.6% **	0.7%
Black	34.6% **	19.1% **	17.7% **	9.3%
Medicare qualification due to disability/ESRD	19.6% **	7.5%	8.4% **	6.1%
30-Day Mortality Rate	8.6%	9.7%	9.2%	9.0%
Presence of Chronic Condition				
Cancer	1.9%	1.4%	1.4%	1.6%
Metastatic Cancer	4.2% **	3.6% *	2.8%	2.4%
AIDS	0.1%	0.1%	0.0%	0.0%
Chronic Pulmonary Disease	5.5% **	7.6% **	8.0% **	10.6%
Coronary Artery Disease	5.3% **	8.1%	7.8%	8.7%
Congestive Heart Failure	9.6%	12.7%	11.9%	10.7%
Peripheral Vascular Disease	0.9% *	1.3%	1.6%	2.1%
Severe Chronic Liver Disease	0.3%	0.5%	0.4%	0.5%
Diabetes with End Organ Damage	7.1%	7.9%	8.0%	6.9%
Chronic Renal Failure	2.7%	2.5%	2.4%	2.0%
Nutritional Deficiencies	3.8%	4.7%	5.5%	4.8%
Dementia	8.5%	8.9%	8.3%	9.5%
Functional Impairment	8.7% *	7.0%	7.2%	6.8%

**Statistically significantly different from non-teaching hospitals at the 1% level.
*Statistically significantly different from non-teaching hospitals at the 5% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

Consistent with other chronic condition results, ulcer patients with metastatic cancer are treated significantly more in major teaching hospitals. Patients with functional impairment are also admitted significantly more often to academic medical centers. Non-teaching hospitals, on the other hand, provide services to a significantly greater percent of patients with chronic pulmonary disease, coronary artery disease, and peripheral vascular disease.

Dehydration

Finally, casemix measures for patients admitted to the hospital with dehydration indicate that, unlike in other medical conditions, the percent of transfers treated does not differ among hospital types (see Table 4-18). One reason for this difference may be that many dehydration patients are elderly individuals usually admitted from skilled nursing facilities, rather than transferred from other acute hospitals. The mortality rate for dehydration patients, while highest in other COTH hospitals, does not differ significantly among the hospital types.

Among the chronic conditions we examined, our results were consistent with other medical conditions. Teaching hospitals treated a higher percent of patients with metastatic cancer and AIDS while non-teaching hospitals provided services to more patients with chronic pulmonary disease, coronary artery disease, peripheral vascular disease, and dementia.

4.4.2 Surgical Procedures

Among the five surgical procedures we examined in detail, casemix measures vary less consistently than among the medical conditions. Overall conclusions that can be drawn are that academic medical centers treat significantly more transfers, outliers, disabled/ESRD patients, and black patients than non-teaching hospitals. These casemix measures vary by procedure among the other COTH and other teaching hospitals, however.

With regard to the chronic conditions, there are few significant differences among the percent of patients treated with certain conditions. The one consistent difference among all surgical procedures is that non-teaching hospitals treat

TABLE 4-18

CASEMIX MEASURES FOR DEHYDRATION PATIENTS

	Academic Medical Centers	Other COTH	Other Teaching	Non-Teaching
Transferred In	1.0%	0.6%	0.6%	0.8%
Outlier Cases	2.5% **	3.3% **	2.2% *	1.3%
Black	33.4% **	20.7% **	16.4% **	10.7%
Medicare qualification due to disability/ESRD	17.9% **	7.0%	7.0%	5.9%
30-Day Mortality Rate	17.0%	17.9%	16.7%	15.7%
Percent with Chronic Condition				
Cancer	8.2%	8.6% *	7.3%	6.6%
Metastatic Cancer	16.5% **	14.2% **	12.4% *	9.8%
AIDS	1.4% **	0.5% *	0.3%	0.2%
Chronic Pulmonary Disease	7.3% **	9.2% **	11.4%	12.9%
Coronary Artery Disease	5.2% **	7.5%	7.4%	8.2%
Congestive Heart Failure	9.0%	11.2%	11.2%	10.1%
Peripheral Vascular Disease	0.9% **	1.7%	1.8%	2.4%
Severe Chronic Liver Disease	0.5%	0.6%	0.8%	0.6%
Diabetes with End Organ Damage	6.3%	5.7%	5.8%	6.7%
Chronic Renal Failure	4.0%	3.5%	3.5%	3.2%
Nutritional Deficiencies	13.0%	13.4%	13.7%	13.4%
Dementia	5.7% *	7.3%	7.1%	7.6%
Functional Impairment	2.3%	2.7%	2.8%	2.7%

**Significantly different from non-teaching hospitals at the 1% level.
*Significantly different from non-teaching hospitals at the 5% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

significantly more patients with chronic pulmonary disease than academic medical centers. Other differences in the percent of patients with specific chronic conditions vary by procedure.

CABG Surgery

As Table 4-19 illustrates, only academic medical centers treat a significantly greater percent of individuals that initially qualified for Medicare through disability or ESRD. Similar to the results we found among the medical conditions, mortality does not vary among the hospital types for CABG surgery patients.

The percent of patients with chronic conditions varies little across hospital type. For CABG patients, there are two significant differences. First, all three teaching hospitals treat fewer patients with chronic pulmonary disease. Second, academic medical centers provide care to a lower percent of patients with diabetes with end organ damage than do non-teaching hospitals.

Colectomy for Patients with Colon Cancer

Colectomy patients who are PPS outliers or who qualify for Medicare due to disability/ESRD receive care significantly more often in academic medical centers than in non-teaching hospitals (Table 4-20). As we have seen previously, mortality rates do not vary significantly by hospital.

Among colectomy patients, there are only two significant differences with regard to chronic conditions. While all these patients have colon cancer, academic medical centers treat a higher percent of patients whose cancer has metastasized than non-teaching hospitals. Non-teaching hospitals also treat more patients with a secondary diagnosis of chronic pulmonary disease.

Total Hip Replacement

Case-mix measures for patients undergoing a total hip replacement are shown in Table 4-21. For these patients, only academic medical centers treat a significantly higher percent of transfers and have a significantly lower mortality rate than non-teaching hospitals.

TABLE 4-19

CASEMIX MEASURES FOR CABG SURGERY PATIENTS

	Academic Medical Centers	Other COTH	Other Teaching	Non-Teaching
Transferred In	31.4% **	28.6% **	23.9% **	18.0%
Outlier Cases	6.9% **	7.1% **	6.7% **	10.9%
Black	5.5% **	3.8% **	3.0% *	2.1%
Medicare qualification due to disability/ESRD	8.8% **	6.6%	7.8%	6.9%
30-Day Mortality Rate	5.8%	5.3%	5.3%	5.0%
Percent with Chronic Condition				
Cancer	0.4%	0.4%	0.3%	0.4%
Metastatic Cancer	0.1%	0.2%	0.1%	0.2%
AIDS	0.0%	0.0%	0.0%	0.0%
Chronic Pulmonary Disease	6.3% **	8.0% **	10.3% *	12.1%
Coronary Artery Disease[a]	59.9%	61.4%	65.1% **	61.6%
Congestive Heart Failure	15.2%	15.2%	14.6%	15.8%
Peripheral Vascular Disease	3.1%	3.7%	3.8%	3.2%
Severe Chronic Liver Disease	0.0%	0.1%	0.1%	0.1%
Diabetes with End Organ Damage	2.5% **	4.0%	4.3%	4.2%
Chronic Renal Failure	1.0%	1.0%	0.7%	0.8%
Nutritional Deficiencies	0.2%	0.2%	0.3%	0.1%
Dementia	0.1%	0.1%	0.1%	0.1%
Functional Impairment	0.7%	0.6%	0.6%	0.5%

**Significantly different from non-teaching hospitals at the 1% level.
*Significantly different from non-teaching hospitals at the 5% level.

(a) All CABG patients have coronary artery diseases (CAD) as a principal diagnosis by definition. Presence of a secondary CAD diagnosis is not particularly meaningful; it is included here for completeness.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

TABLE 4-20

CASEMIX MEASURES FOR COLECTOMY PATIENTS WITH COLON CANCER

	Academic Medical Centers	Other COTH	Other Teaching	Non-Teaching
Transferred In	3.5% **	1.7% *	1.4%	0.8%
Outlier Cases	4.3% *	3.6%	3.2%	2.6%
Black	17.6% **	10.8% **	9.4% **	4.7%
Medicare qualification due to disability/ESRD	3.5% **	2.1%	2.5%	1.7%
30-Day Mortality Rate	3.3%	3.5%	4.6%	4.6%
Percent with Chronic Condition				
Cancer	0.8%	0.6%	0.8%	1.0%
Metastatic Cancer	42.5% *	39.2%	39.6%	37.1%
AIDS	0.0%	0.0%	0.0%	0.0%
Chronic Pulmonary Disease	6.3% **	8.0%	9.2%	10.3%
Coronary Artery Disease	8.1%	9.2%	8.7%	7.7%
Congestive Heart Failure	5.9%	6.5%	6.5%	6.8%
Peripheral Vascular Disease	1.7%	1.2%	1.5%	1.6%
Severe Chronic Liver Disease	0.8%	0.8%	0.8%	1.0%
Diabetes with End Organ Damage	1.1%	2.4%	2.2%	2.2%
Chronic Renal Failure	0.4%	0.1%	0.4%	0.4%
Nutritional Deficiencies	1.2%	1.7%	2.3%	2.2%
Dementia	0.5%	0.6%	0.6%	0.8%
Functional Impairment	0.6%	0.8%	0.6%	0.7%

**Significantly different from non-teaching hospitals at the 1% level.
*Significantly different from non-teaching hospitals at the 5% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

TABLE 4-21

CASEMIX MEASURES FOR TOTAL HIP REPLACEMENT PATIENTS

	Academic Medical Centers	Other COTH	Other Teaching	Non-Teaching
Transferred In	1.1% *	0.5%	0.5%	0.4%
Outlier Cases	1.4%	1.2%	0.8%	1.1%
Black	10.6% **	7.9% **	4.5% *	3.0%
Medicare qualification due to disability/ESRD	13.4% **	6.6% *	5.6%	4.5%
30-Day Mortality Rate	0.8% *	1.2%	1.4%	2.0%
Percent with Chronic Condition				
Cancer	0.4%	0.3%	0.5%	0.5%
Metastatic Cancer	1.3%	1.0%	0.7%	0.7%
AIDS	0.0%	0.0%	0.0%	0.0%
Chronic Pulmonary Disease	5.3% **	6.4% *	8.1%	9.1%
Coronary Artery Disease	7.6%	8.9%	9.1%	9.2%
Congestive Heart Failure	2.5% *	2.8%	3.4%	4.1%
Peripheral Vascular Disease	0.8% *	1.1%	1.4%	2.0%
Severe Chronic Liver Disease	0.2%	0.1%	0.2%	0.1%
Diabetes with End Organ Damage	0.7%	1.1%	1.4%	1.6%
Chronic Renal Failure	1.0% *	0.5%	0.6%	0.4%
Nutritional Deficiencies	0.3%	0.3%	0.2%	0.7%
Dementia	0.6%	0.7%	1.2%	1.2%
Functional Impairment	0.5%	0.8%	0.7%	0.8%

**Significantly different from non-teaching hospitals at the 1% level.
*Significantly different from non-teaching hospitals at the 5% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

The percent of PPS outlier cases does not vary significantly among the hospitals, a result that is different from other procedures we have examined. One explanation for the small variation is that many patients may be discharged to a skilled nursing facility or other rehabilitation setting after hip surgery and are therefore less likely to require a longer hospital stay to receive certain health care services.

Non-teaching hospitals treat significantly more total hip replacement patients with congestive heart failure and peripheral vascular disease than do academic medical centers and more with chronic pulmonary disease than either academic medical centers or the other COTH hospitals. Academic medical centers treat a significantly higher percent of patients with chronic renal failure, although the percent difference among the hospitals is less than one percent.

Laminectomy

There are few differences in casemix among laminectomy patients treated in other COTH, other teaching, and non-teaching hospitals (Table 4-22). The one significant difference among those hospitals is that other COTH hospitals treat a greater percent of black patients. Between academic medical centers and non-teaching hospitals only, however, significant differences exist in the types of laminectomy patients treated. Academic medical centers treat significantly more transfers, outliers, black patients, and patients who qualify for Medicare due to disability or ESRD. Similar to other procedures, there were no differences in mortality rate among laminectomy patients.

The percent of laminectomy patients with chronic conditions does not vary much across hospitals. Only four significant differences exist. Academic medical centers treat a higher percent of patients with chronic pulmonary disease and with functional impairment than non-teaching hospitals. Other COTH hospitals provide care to more patients with coronary artery disease. They also, along with other teaching hospitals, treat more patients with nutritional deficiencies.

TABLE 4-22

CASEMIX MEASURES FOR LAMINECTOMY PATIENTS

	Academic Medical Center	Other COTH	Other Teaching	Non-Teaching
Transferred In	3.1% **	1.7%	1.8%	1.1%
Outlier Cases	2.9% **	1.3%	1.0%	0.6%
Black	10.2% **	6.1% **	5.1%	3.5%
Medicare qualification due to disability/ESRD	24.4% **	14.4%	16.5%	16.8%
30-Day Mortality Rate	1.1%	0.8%	0.4%	0.6%
Percent with Chronic Condition				
Cancer	0.7%	0.4%	0.2%	0.5%
Metastatic Cancer	1.1%	1.0%	0.8%	0.6%
AIDS	0.0%	0.0%	0.0%	0.0%
Chronic Pulmonary Disease	5.3% **	7.6%	8.6%	9.6%
Coronary Artery Disease	7.3%	10.4% *	9.4%	7.5%
Congestive Heart Failure	1.8%	1.9%	1.5%	2.1%
Peripheral Vascular Disease	1.1%	1.7%	1.6%	2.0%
Severe Chronic Liver Disease	0.2%	0.1%	0.1%	0.2%
Diabetes with End Organ Damage	1.7%	2.5%	3.1%	2.5%
Chronic Renal Failure	0.7%	0.5%	0.5%	0.4%
Nutritional Deficiencies	0.2%	0.3% *	0.3% *	0.0%
Dementia	0.0%	0.3%	0.1%	0.1%
Functional Impairment	4.1% *	2.9%	2.5%	2.5%

**Significantly different from non-teaching hospitals at the 1% level.
*Significantly different from non-teaching hospitals at the 5% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

TURP

Our last surgical procedure, TURPs, resemble the medical conditions with regard to casemix results (Table 4-23). Academic medical centers alone treat a significantly higher percent of disabled/ESRD Medicare patients and have a significantly lower mortality rate.

Non-teaching hospitals care for a greater percent of TURP patients with chronic conditions. Non-teaching hospitals treat a significantly higher percent of TURP patients with chronic pulmonary disease than all three types of teaching hospitals. They also treat significantly more TURP patients with peripheral vascular disease than academic institutions and other COTH hospitals, and more patients with diabetes with end organ damage than academic medical centers.

4.5 Department Level Cost Analysis

Our motivation for examining costs at the department level was to compare them to Part B bills generated by physicians. Such a comparison done by hospital type could indicate the substitute or complementary use of inputs and would enable a more rigorous examination of the "extra testing" hypothesis where presumably more resources are used in teaching hospitals by residents. Department level costs were derived from hospital Medicare Cost Reports (MCRs) and MedPAR admission level charge information. Specifically, cost-to-charge ratios were created from hospital cost reports and were multiplied by corresponding charge information from the MedPAR file for each admission.

In Tables 4-24 through 4-33, we present mean department level Part A costs per admission, total Part B charges per admission, and Part A cost and Part B charges combined for our ten admission-level conditions. Due to incompatible definitions in hospital ancillary cost centers and physician Part B charge definitions, we were only able to unarbitrarily align Part A costs with Part B physician charges for radiology. Thus, in Table 4-34 we show a side by side comparison of radiology Part A costs and Part B charges. All values in these tables have been deflated by the PPS Wage Index. As done for previous tables, significance tests reflect each teaching hospital type versus the non-teaching hospital category.

TABLE 4-23

CASEMIX MEASURES FOR TURP PATIENTS

	Academic Medical Centers	Other COTH	Other Teaching	Non-Teaching
Transferred In	1.9% **	0.9% *	1.2% **	0.5%
Outlier Cases	1.7% **	1.6% **	1.2% **	0.5%
Black	16.9% **	10.7% **	9.2% **	4.6%
Medicare qualification due to disability/ESRD	4.4% **	2.4%	3.0%	2.7%
30-Day Mortality Rate	0.6% *	0.7%	0.9%	1.1%
Percent with Chronic Condition				
Cancer	0.6%	0.7%	0.9%	0.7%
Metastatic Cancer	3.9%	3.8%	3.5%	3.2%
AIDS	0.0%	0.0%	0.0%	0.0%
Chronic Pulmonary Disease	7.3% **	9.1% **	12.2% **	14.9%
Coronary Artery Disease	11.0%	12.8%	12.2%	11.8%
Congestive Heart Failure	3.3%	3.4%	3.5%	3.7%
Peripheral Vascular Disease	1.2% **	1.6% **	1.8%	2.4%
Severe Chronic Liver Disease	0.1%	0.1%	0.1%	0.1%
Diabetes with End Organ Damage	1.4% *	2.0%	2.1%	2.3%
Chronic Renal Failure	0.4%	0.7%	0.9%	0.6%
Nutritional Deficiencies	0.2%	0.4%	0.3%	0.3%
Dementia	0.7%	0.8%	0.8%	1.0%
Functional Impairment	1.8%	1.8%	1.5%	1.8%

**Significantly different from non-teaching hospitals at the 1% level.
*Significantly different from non-teaching hospitals at the 5% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

TABLE 4-24

MEAN DEPARTMENT-LEVEL PART A COSTS AND TOTAL PART B CHARGES PER ADMISSION, BY HOSPITAL TYPE, FOR AMI

	ACADEMIC MEDICAL CENTERS (N=14,018)		COTH HOSPITALS (N=27,217)		OTHER TEACHING HOSPITALS (N=37,982)		NON-TEACHING HOSPITALS (N=22,843)	
Hospital Departments	MEAN	STD DEV.	MEAN	STD DEV.	MEAN	STD DEV.	MEAN	STD DEV.
Operating Room	$26.06 ***	(205.43)	$21.62 ***	(369.12)	$16.90 ***	(214.70)	$7.49	(392.89)
Pharmacy	409.87 ***	(872.24)	412.50 ***	(986.47)	491.88 ***	(1,639.44)	583.14	(3,064.60)
Lab	1,741.33 ***	(1,962.32)	1,561.09 ***	(1,846.41)	1,333.54 ***	(2,019.09)	1,209.33	(3,271.16)
Radiology	440.26 ***	(599.24)	311.82 ***	(492.44)	304.49 ***	(744.18)	272.96	(1,243.58)
Medical Supplies	298.43 **	(629.32)	256.13 ***	(659.44)	305.97 *	(960.97)	337.29	(2,096.78)
Anesthesiology	1.54	(19.70)	0.73 ***	(15.52)	1.93 ***	(35.49)	0.72	(30.23)
Inhalation Therapy	287.22 ***	(780.53)	287.74 ***	(877.32)	268.45 ***	(1,051.99)	348.36	(2,160.36)
Physical Therapy	76.80 ***	(210.15)	42.53	(156.42)	43.87	(361.56)	38.34	(628.94)
Speech Pathology	2.21 **	(34.63)	2.88 ***	(37.59)	2.00 *	(46.46)	0.90	(53.48)
Outpatient/Emergency Room	110.35 ***	(431.69)	46.10	(257.81)	32.22 ***	(227.35)	46.60	(568.67)
Other Ancillary Costs	10.60 ***	(131.38)	2.14	(50.02)	3.85	(84.19)	4.43	(216.31)
Emergency Room	192.56 *	(390.75)	251.64 ***	(503.49)	195.41 *	(509.33)	179.57	(865.51)
Renal Dialysis	35.97 ***	(304.47)	15.44 *	(209.42)	12.85	(262.31)	7.01	(451.24)
Other Reimbursable Costs	168.99 ***	(604.10)	244.91 ***	(2,451.20)	137.96 *	(877.07)	166.70	(1,937.34)
Clinic	2.49	(23.59)	0.93	(21.33)	0.90	(55.18)	0.58	(31.66)
Routine Accommodation, per diem	2,784.62 ***	(4,814.44)	2,204.16 ***	(4,075.64)	1,666.16 ***	(4,422.00)	1,198.11	(5,605.61)
ICU cost, per diem	3,700.52 ***	(5,852.55)	3,399.41 ***	(5,444.47)	2,944.90 ***	(6,106.14)	2,427.44	(9,015.09)
Total Part A Dept. Costs	10,289.81 ***	(10,661.53)	9,061.77 ***	(10,259.00)	7,763.30 ***	(11,418.77)	6,828.95	(17,752.36)
Total Part B Charges	1,044.37 ***	(928.03)	1,060.18 ***	(1,104.37)	1,032.94 ***	(1,583.41)	967.61	(2,885.12)
Total Part A Dept. Costs + and Part B Charges	$11,334.18 ***	(11,109.24)	$10,121.94 ***	(10,852.56)	$8,796.23 ***	(12,278.62)	$7,796.57	(19,128.35)

*Significantly different from non-teaching hospitals at the 10% level.
**Significantly different from non-teaching hospitals at the 5% level.
***Significantly different from non-teaching hospitals at the 1% level.

NOTE: All values deflated by the HCFA Wage Index.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

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4.5.1 Medical Conditions

Total Part A costs and total Part B charges were significantly greater in teaching hospitals compared to non-teaching hospitals for all five medical conditions. An analysis of Part A costs shows that for most conditions, operating room, emergency room, laboratory, radiology, and per diems (routine and ICU) are significantly higher in teaching hospitals. These findings may reflect a broader scope of services available at the department level for teaching hospitals versus non-teaching hospitals. Further, other department costs such as speech pathology and renal dialysis are also higher in teaching hospitals, although the magnitude of differences is not very large. In contrast, teaching hospitals have lower costs in pharmacy and inhalation therapy departments than non-teaching hospitals.

A comparison of total Part A costs and Part B charges combined reveals that non-teaching hospitals are consistently about 34 percent lower than the most expensive type of teaching hospital across all medical conditions.

Medically Treated AMIs

Table 4-24 reveals that academic medical centers have the highest total Part A costs and Part B charges (combined) per admission at $11,344.18, which is about 10 percent, 22 percent, and 32 percent higher than for other COTH, other teaching, and non-teaching hospitals, respectively. Almost 80 percent of the difference between academic medical centers and non-teaching hospitals is due to higher routine accommodations and ICU costs per diem in academic medical centers.

Most hospital department costs are statistically greater in teaching hospitals versus non-teaching hospitals, with the highest costs found most frequently in academic medical centers. Pharmacy and inhalation therapy department costs were significantly lower in all three teaching hospital types than in non-teaching hospitals.

Pneumonia

Department level costs are compared across hospital types for bacterial and pneumococcal pneumonia in Table 4-25. Routine accommodations per diem, the largest share of total department level costs, were significantly higher in all three types of

TABLE 4-25

MEAN DEPARTMENT-LEVEL PART A COSTS AND TOTAL PART B CHARGES PER ADMISSION, BY HOSPITAL TYPE, FOR BACTERIAL AND PNEUMOCOCCAL PNEUMONIA

	ACADEMIC MEDICAL CENTERS (N=5,936)		COTH HOSPITALS (N=9,221)		OTHER TEACHING HOSPITALS (N=14,754)		NON-TEACHING HOSPITALS (N=11,643)	
Hospital Departments	MEAN	STD DEV.	MEAN	STD DEV.	MEAN	STD DEV.	MEAN	STD DEV.
Operating Room	$82.54 *	(447)	$66.50	(365.52)	$75.41	(662.27)	$62.37	(1,017.23)
Pharmacy	928.70 ***	(2,130)	986.43 **	(2,739.13)	1,026.15	(3,341.68)	1,104.48	(5,870.52)
Lab	1,480.82 ***	(3,283)	1,350.24 ***	(2,520.47)	1,123.56 ***	(2,838.45)	914.79	(4,028.89)
Radiology	538.33 ***	(1,104)	426.10 ***	(795.88)	403.48 ***	(1,132.08)	351.49	(1,859.17)
Medical Supplies	426.48	(1,419)	428.19	(1,582.20)	492.84 *	(2,969.71)	427.28	(3,141.96)
Anesthesiology	10.52 ***	(101)	5.07	(49.33)	9.08 ***	(113.46)	4.44	(113.62)
Inhalation Therapy	799.48 ***	(2,258)	953.26	(3,365.20)	855.14 **	(3,171.38)	978.47	(6,042.48)
Physical Therapy	124.29 ***	(509)	74.95 **	(334.33)	71.24	(600.95)	57.47	(891.33)
Speech Pathology	5.42 ***	(43)	9.62 ***	(83.10)	4.80 **	(78.70)	2.10	(92.32)
Outpatient/Emergency Room	85.07 ***	(303)	61.65 ***	(356.84)	34.45 *	(267.32)	27.44	(353.27)
Other Ancillary Costs	2.52	(57)	0.62	(22.44)	2.49	(78.29)	2.16	(104.90)
Emergency Room	166.79 ***	(285)	158.84 ***	(308.79)	142.27 ***	(358.99)	99.54	(808.00)
Renal Dialysis	59.67 ***	(528)	33.48 **	(398.35)	30.46 *	(570.01)	14.15	(864.70)
Other Reimbursable Costs	121.71	(676)	217.60 ***	(1,562.01)	90.43	(1,067.02)	88.14	(1,996.38)
Clinic	3.98 ***	(36)	1.44 ***	(33.07)	2.47 ***	(60.62)	0.29	(26.46)
Routine Accommodation, per diem	4,892.27 ***	(9,248)	5,347.87 ***	(13,430.36)	3,739.51 ***	(8,529.18)	3,024.40	(11,064.41)
ICU cost, per diem	2,634.86 ***	(10,414)	2,198.89 ***	(10,573.44)	1,503.09 ***	(10,222.90)	983.20	(13,378.43)
Total Part A Costs	12,363.43 ***	(21,302)	12,320.75 ***	(25,078.25)	9,606.87 ***	(24,985.64)	8,142.18	(33,323.29)
Total Part B Charges	885.25 *	(1,393)	1,096.89 ***	(1,828.22)	937.71 ***	(2,248.09)	820.81	(3,768.84)
Total Part A Dept. Costs + and Part B Charges	$13,248.68 ***	(22,140)	$13,417.64 ***	(26,041.14)	$10,544.58 ***	(26,411.01)	$8,962.98	(36,062.97)

*Significantly different from non-teaching hospitals at the 10% level.
**Significantly different from non-teaching hospitals at the 5% level.
***Significantly different from non-teaching hospitals at the 1% level.

NOTE: All values deflated by the HCFA Wage Index.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

teaching hospitals and highest in other COTH hospitals. Similarly, teaching hospitals had significantly higher lab, radiology and emergency room costs. ICU costs per diem were also greatest in academic medical centers ($2,635 per admission) and lowest in non-teaching hospitals ($983). Nonteaching hospitals were significantly more costly in terms of pharmacy and inhalation therapy department costs than most teaching hospitals.

Part B charges per admission were significantly greater in all teaching hospital types versus non-teaching hospitals. Other COTH and other teaching hospitals both showed higher Part B costs than academic medical centers.

Acute Stroke (Cerebral Infarction)

Department level costs for acute stroke are compared across hospital types in Table 4-26. Consistent with other medical conditions, most department costs per admission are greater in teaching hospitals than non-teaching hospitals. Total Part A department costs per admission are approximately 35 percent lower in non-teaching hospitals versus academic medical centers while total Part B charges are about 15 percent lower. Much of the total difference can be traced to routine accommodation and ICU per diem costs. Routine accommodations in academic medical centers, for example, are twice as great as those in non-teaching hospitals ($5,340 vs. $2,639).

Laboratory, emergency room, and per diem cost centers are all consistently higher in teaching hospitals. Once again, pharmacy and inhalation therapy costs are significantly lower in teaching hospitals.

Bleeding Ulcers

Table 4-27 displays mean department level costs per admission across hospital types for bleeding ulcers. In terms of costs by hospital type, comparisons were similar to other medical conditions. Teaching hospitals were significantly more costly in total, especially for routine accommodation and ICU per diem costs. Lab, radiology, anesthesiology, emergency room, and renal dialysis costs were all significantly greater in at least one teaching hospital type compared to the non-teaching hospital cohort. Pharmacy and inhalation therapy costs were greater in non-teaching hospitals for

TABLE 4-26

MEAN DEPARTMENT-LEVEL PART A COSTS AND TOTAL PART B CHARGES PER ADMISSION, BY HOSPITAL TYPE, FOR CEREBRAL INFARCTIONS

	ACADEMIC MEDICAL CENTERS (N=12,196)		COTH HOSPITALS (N=22,899)		OTHER TEACHING HOSPITALS (N=34,437)		NON-TEACHING HOSPITALS (N=22,483)	
Hospital Department	MEAN	STD DEV.	MEAN	STD DEV.	MEAN	STD DEV.	MEAN	STD DEV.
Operating Room	$89.80 ***	(531)	$63.86 *	(448.34)	$55.35	(548.53)	$48.52	(994.48)
Pharmacy	355.38 ***	(1,049)	335.47 ***	(1,020.26)	378.69 **	(1,551.57)	426.82	(2,826.13)
Lab	1,019.26 ***	(1,725)	902.49 ***	(1,616.97)	787.15 *	(1,601.00)	750.71	(2,532.88)
Radiology	754.81 ***	(841)	510.09 ***	(595.96)	614.32	(1,078.52)	612.00	(1,710.93)
Medical Supplies	296.43	(985)	225.79 ***	(922.63)	299.62	(1,547.38)	299.48	(2,091.28)
Anesthesiology	11.73 ***	(95)	4.42	(50.62)	6.24 *	(100.70)	4.11	(120.93)
Inhalation Therapy	239.84 *	(1,331)	215.91	(1,241.24)	197.65 **	(1,724.26)	242.42	(2,385.18)
Physical Therapy	330.35 *	(671)	300.52	(705.03)	322.09	(1,030.17)	305.09	(1,783.01)
Speech Pathology	53.00 *	(175)	82.64 ***	(226.93)	63.20 ***	(291.28)	44.11	(542.49)
Outpatient/Emergency Room	70.64 ***	(236)	46.83 ***	(211.71)	30.92	(255.55)	34.45	(454.37)
Other Ancillary Costs	2.55 *	(50)	0.98 ***	(21.29)	2.13 ***	(37.55)	4.15	(112.43)
Emergency Room	142.46 ***	(278)	171.30 ***	(317.40)	135.60 *	(305.52)	125.64	(630.40)
Renal Dialysis	24.68 ***	(304)	19.98 ***	(420.19)	14.17 ***	(348.18)	5.15	(375.73)
Other Reimbursable Costs	140.04	(607)	233.88 ***	(1,543.71)	136.53	(761.24)	139.30	(2,038.00)
Clinic	9.37 ***	(94)	1.61 **	(28.68)	2.22 ***	(71.34)	0.56	(55.24)
Routine Accommodation, per diem	5,340.39 ***	(9,259)	4,958.60 ***	(11,716.73)	3,615.76 ***	(8,927.04)	2,639.25	(10,584.56)
ICU cost, per diem	1,221.11 ***	(5,076)	857.57	(6,787.77)	786.95	(5,970.29)	769.34	(6,800.04)
Total Part A Dept Costs	10,101.85 ***	(14,992)	8,931.93 ***	(17,162.95)	7,448.57 ***	(16,139.05)	6,451.10	(21,200.13)
Total Part B Charges	1,014.03 ***	(1,149)	1,054.60 ***	(1,191.34)	961.46 ***	(1,610.14)	865.38	(2,600.27)
Total Part A Dept. Costs + and Part B Charges	$11,115.87 ***	(15,587)	$9,986.53 ***	(17,668.89)	$8,410.03 ***	(16,957.20)	$7,316.48	(22,827.32)

*Significantly different from non-teaching hospitals at the 10% level.
**Significantly different from non-teaching hospitals at the 5% level.
***Significantly different from non-teaching hospitals at the 1% level.

NOTE: All values deflated by the HCFA Wage index.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

TABLE 4-27

MEAN DEPARTMENT-LEVEL PART A COSTS AND TOTAL PART B CHARGES PER ADMISSION, BY HOSPITAL TYPE, FOR BLEEDING ULCERS

	ACADEMIC MEDICAL CENTERS (N=6,914)		COTH HOSPITALS (N=597)		OTHER TEACHING HOSPITALS (N=6,200)		NON-TEACHING HOSPITALS (N=9,981)	
Hospital Department	MEAN	STD DEV.	MEAN	STD DEV.	MEAN	STD DEV.	MEAN	STD DEV.
Operating Room	$82.79 *	(427)	$67.51	(377.25)	$80.13 *	(655.45)	$59.24	(953.97)
Pharmacy	475.35 ***	(883)	443.45 ***	(845.61)	569.91	(1,562.27)	600.26	(2,343.49)
Lab	842.77 ***	(1,164)	730.21 ***	(1,067.02)	715.75 ***	(1,796.18)	604.52	(1,969.50)
Radiology	348.09 ***	(602)	251.32	(414.89)	287.52 ***	(770.06)	253.88	(1,159.23)
Medical Supplies	242.73	(815)	214.37 ***	(664.19)	304.86 **	(1,263.55)	259.99	(1,502.81)
Anesthesiology	10.02 ***	(86)	5.25	(61.07)	10.54 ***	(108.15)	5.39	(142.06)
Inhalation Therapy	111.42 ***	(537)	122.87	(647 91)	144.68	(906.98)	160.14	(1,598.10)
Physical Therapy	78.94 ***	(317)	51.04	(218.51)	55.98	(415.40)	48.12	(639.74)
Speech Pathology	4.41 *	(59)	6.30 ***	(49.20)	2.96	(74.85)	1.66	(135.35)
Outpatient/Emergency Room	62.40 ***	(198)	47.66 ***	(190.62)	28.45	(186.62)	31.18	(437.58)
Other Ancillary Costs	0.66	(13)	0.41	(14.48)	1.06	(28.59)	1.14	(81.65)
Emergency Room	154.85 ***	(251)	162.75 ***	(256.85)	139.27 ***	(302.16)	106.24	(567.10)
Renal Dialysis	19.12 ***	(244)	16.96 ***	(338.49)	8.73	(236.01)	3.90	(304.64)
Other Reimbursable Costs	56.42	(570)	109.84 ***	(1,328.49)	52.79	(497.59)	67.22	(1,050.06)
Clinic	3.40 ***	(32)	0.96	(19.03)	1.65 **	(46.70)	0.43	(38.55)
Routine Accommodation, per diem	4,817.75 ***	(7,732)	4,262.17 ***	(7,496.78)	3,291.78 ***	(7,054.50)	2,342.98	(8,268.42)
ICU cost, per diem	365.38 ***	(2,579)	245.77	(2,347.45)	237.38	(2,542.09)	198.19	(3,967.87)
Total Part A Dept. Costs	7,474.49 ***	(11,094)	6,738.86 ***	(10,000.95)	5,933.41 ***	(11,763.89)	4,744.49	(14,788.24)
Total Part B Charges	584.04 *	(820)	688.79 ***	(1,022.91)	647.81 ***	(1,426.57)	547.09	(1,964.91)
Total Part A Dept. Costs + Part B Charges	$8,058.53 ***	(11,575)	$7,427.65 ***	(10,584.81)	$6,581.22 ***	(12,722.88)	$5,291.59	(16,024.44)

*Significantly different from non-teaching hospitals at the 10% level.
**Significantly different from non-teaching hospitals at the 5% level.
***Significantly different from non-teaching hospitals at the 1% level.

NOTE: All values deflated by the HCFA Wage Index.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

bleeding ulcer patients which is consistent with our findings for other medical conditions.

Dehydration

Our final medical condition, dehydration, shows similar patterns in terms of costs with other medical conditions (Table 4-28). Routine and ICU per diem costs are significantly greater in all teaching hospital types versus non-teaching hospitals. Radiology, lab, renal dialysis, and emergency room cost centers all are significantly greater in at least one teaching hospital type versus non-teaching hospitals. Pharmacy and inhalation therapy costs are statistically higher in non-teaching hospitals compared to academic medical centers.

4.5.2 Surgical Procedures

Department level costs per admission were less often significantly different across hospital types compared to medical conditions. Some surgical conditions were significantly less costly in teaching hospitals when Part A costs and Part B charges were combined. Some consistent patterns did emerge for individual department costs. Laboratory, radiology, anesthesiology, and routine and ICU per diem costs were consistently higher in teaching hospitals than in non-teaching hospitals. Pharmacy, medical supplies, and inhalation therapy costs were generally higher in non-teaching hospitals versus teaching hospitals.

CABG Surgery

In Table 4-29, total Part A department costs and total Part B charges per admission, summed are statistically higher in non-teaching hospitals ($34,407) versus other COTH ($32,635) and other teaching hospitals ($31,236). Academic medical centers were not statistically different. Total Part B charges are significantly lower in all teaching hospital types compared to non-teaching hospitals, and were lowest in academic medical centers. Total Part A department costs per admission were significantly higher in non-teaching hospitals versus other teaching hospitals but significantly lower versus academic medical centers.

TABLE 4-28

MEAN DEPARTMENT-LEVEL PART A COSTS AND TOTAL PART B CHARGES, BY HOSPITAL TYPE, FOR DEHYDRATION

	ACADEMIC MEDICAL CENTERS (N=14,018)		COTH HOSPITALS (N=27,217)		OTHER TEACHING HOSPITALS (N=37,982)		NON-TEACHING HOSPITALS (N=22,843)	
Hospital Department	MEAN	STD DEV.	MEAN	STD DEV.	MEAN	STD DEV.	MEAN	STD DEV.
Operating Room	$80.98	(538)	$65.00	(387.09)	$72.02	(583.39)	$77.25	(1,084.28)
Pharmacy	382.98 *	(888)	404.04	(1,177.81)	435.15	(1,763.58)	438.65	(2,340.07)
Lab	812.53 ***	(1,173)	763.32 ***	(1,311.50)	644.92 ***	(1,394.06)	563.84	(1,927.26)
Radiology	337.34 ***	(538)	287.90	(516.43)	308.00 ***	(811.24)	268.39	(1,230.56)
Medical Supplies	209.99	(645)	203.28	(929.35)	250.01	(1,376.06)	233.81	(1,544.22)
Anesthesiology	9.74 ***	(111)	4.61	(50.84)	7.77 ***	(107.29)	4.05	(116.37)
Inhalation Therapy	103.43 **	(648)	138.36	(973.78)	124.63	(1,105.28)	147.96	(1,544.83)
Physical Therapy	68.95	(298)	65.58	(254.52)	73.00	(600.70)	60.87	(768.85)
Speech Pathology	3.26 *	(28)	7.50 ***	(67.08)	3.78 *	(54.41)	1.75	(73.97)
Outpatient/Emergency Room	53.90 ***	(166)	45.69 ***	(194.98)	26.14	(173.55)	22.19	(325.11)
Other Ancillary Costs	0.47	(7)	0.73	(40.45)	1.27	(31.88)	1.59	(74.34)
Emergency Room	123.55 ***	(222)	129.34 ***	(253.14)	105.77 ***	(266.55)	88.76	(507.75)
Renal Dialysis	32.44 ***	(717)	21.26 ***	(422.78)	12.19	(252.01)	6.06	(333.51)
Other Reimbursable Costs	50.73	(309)	118.37 ***	(906.05)	64.47	(580.46)	65.49	(1,343.18)
Clinic	4.70 ***	(53)	1.09 ***	(16.18)	2.63 ***	(64.41)	0.30	(16.87)
Routine Accommodation, per diem	3,941.37 ***	(6,721)	4,278.01 ***	(8,941.75)	3,296.10 ***	(10,410.62)	2,331.31	(9,370.63)
ICU cost, per diem	386.53 ***	(2,689)	332.29 ***	(2,745.53)	280.02 *	(3,108.77)	205.68	(3,540.89)
Total Part A Dept. Costs	6,602.87 ***	(10,270)	6,871.38 ***	(12,582.11)	5,707.87 ***	(14,485.29)	4,517.97	(15,526.85)
Total Part B Charges	586.87	(829)	758.26 ***	(1,145.29)	666.28 ***	(1,457.97)	582.25	(2,185.28)
Total Part A Dept. Cost and Part B Charges	$7,189.75 ***	(10,744)	$7,629.63 ***	(13,220.24)	$6,374.15 ***	(15,256.95)	$5,100.22	(16,934.28)

*Significantly different from non-teaching hospitals at the 10% level.
**Significantly different from non-teaching hospitals at the 5% level.
***Significantly different from non-teaching hospitals at the 1% level.

NOTE: All values deflated by the HCFA Wage Index.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

TABLE 4-29

MEAN DEPARTMENT-LEVEL PART A COSTS AND TOTAL PART B CHARGES PER ADMISSION, BY HOSPITAL TYPE, FOR CABG SURGERY

	ACADEMIC MEDICAL CENTERS (N=20,415)		COTH HOSPITALS (N=29,161)		OTHER TEACHING HOSPITALS (N=29,623)		NON-TEACHING HOSPITALS (N=7,679)	
Hospital Departments	MEAN	STD DEV.	MEAN	STD DEV.	MEAN	STD DEV.	MEAN	STD DEV.
Operating Room	$4,383.11 ***	(4,039)	$4,473.11 ***	(4,450.87)	$4,735.00 *	(8,463.91)	$5,007.71	(10,750.71)
Pharmacy	1,342.24 ***	(2,281)	1,359.01 ***	(2,655.84)	1,754.33 ***	(3,740.64)	2,145.88	(6,575.25)
Lab	4,875.86 ***	(6,171)	4,029.75 *	(4,661.47)	3,883.03	(5,340.46)	3,865.98	(7,443.34)
Radiology	902.04 ***	(1,270)	645.68	(980.64)	684.92	(1,552.41)	649.79	(1,742.67)
Medical Supplies	2,315.95 ***	(3,170)	2,531.09 ***	(3,331.35)	2,943.98 ***	(4,831.72)	4,025.49	(8,849.60)
Anesthesiology	650.37 ***	(1,378)	292.69 ***	(455.81)	387.39 *	(858.15)	421.04	(1,513.95)
Inhalation Therapy	1,160.46 ***	(3,080)	1,232.07 ***	(2,745.32)	1,167.58 ***	(3,251.77)	1,405.98	(4,897.41)
Physical Therapy	236.81 ***	(644)	129.70 ***	(433.34)	153.28	(986.75)	171.78	(1,187.74)
Speech Pathology	7.47	(110)	10.76 ***	(101.05)	8.57	(120.51)	4.36	(167.10)
Outpatient/Emergency Room	39.69 ***	(297)	23.00	(239.42)	25.10	(728.19)	27.37	(337.01)
Other Ancillary Costs	10.42 ***	(177)	1.47 ***	(37.81)	5.74 ***	(182.65)	19.38	(232.24)
Emergency Room	42.22 ***	(191)	59.50	(249.65)	55.15	(739.62)	54.79	(406.50)
Renal Dialysis	76.31 *	(748)	58.70	(980.75)	43.83	(730.98)	49.88	(1,138.63)
Other Reimbursable Costs	495.31 ***	(1,643)	733.24 ***	(2,606.35)	499.15 ***	(2,204.36)	203.49	(1,144.54)
Clinic	2.24 **	(48)	1.73 ***	(25.39)	1.36 ***	(46.29)	8.53	(149.84)
Routine Accommodation, per diem	4,384.67 ***	(8,264)	3,513.74 ***	(5,788.51)	2,731.11 ***	(5,270.04)	2,128.84	(6,656.05)
ICU cost, per diem	7,897.68 ***	(13,942)	7,270.26	(13,531.51)	5,904.67 ***	(13,557.02)	6,937.31	(18,009.51)
Total Part A Dept. Costs	28,622.86 ***	(29,157)	26,365.50	(27,928.54)	24,982.16 ***	(31,821.09)	27,125.60	(42,188.40)
Total Part B Charges	5,844.18 ***	(3,274)	6,270.05 ***	(3,605.30)	6,254.45 ***	(4,724.74)	6,922.11	(7,287.90)
Total Part A Dept. Costs + and Part B Charges	$34,467.01	(30,777)	$32,635.55 ***	(29,655.59)	$31,236.61 ***	(34,103.29)	$34,047.71	(46,265.10)

*Significantly different from non-teaching hospitals at the 10% level.
**Significantly different from non-teaching hospitals at the 5% level.
***Significantly different from non-teaching hospitals at the 1% level.

NOTE: All values deflated by the HCFA Wage Index.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

An analysis of individual department costs for CABG surgery reveals significantly greater costs per admission in teaching hospitals for lab, radiology, anesthesiology, other reimbursable costs, and routine and ICU per diem costs. In contrast, operating room, pharmacy, medical supplies, inhalation therapy, and physical therapy are generally lower in teaching hospitals compared to non-teaching hospitals.

Colectomy for Patients with Colon Cancer

Total Part A department costs and total Part B charges per admission, combined, are significantly lower in non-teaching hospitals ($15,246) versus academic medical centers ($18,915), but no different from other COTH and other teaching hospitals (Table 4-30). Most of the cost differential between academic medical centers and non-teaching hospitals is explained by higher routine and ICU costs per diem, followed by higher operating room and lab costs. No statistical differences were found between non-teaching and other COTH and other teaching hospitals for ICU costs, operating room, radiology, and inhalation therapy costs (among others).

Teaching hospitals show consistently lower costs per admission versus non-teaching hospitals for pharmacy and medical supplies costs and total Part B charges.

Total Hip Replacement

In Table 4-31, mean department level costs and total Part B charges are presented for total hip replacement. Total Part A costs and Part B charges per admission, summed, are significantly higher in academic medical centers ($16,643) versus non-teaching hospitals ($14,246). No statistical differences were found between non-teaching hospitals and other COTH and other teaching hospitals. Routine accommodation and ICU costs per diem, operating room, and lab costs were significantly greater in academic medical centers. Pharmacy, medical supplies, inhalation therapy, and physical therapy costs were significantly greater in non-teaching hospitals versus at least one type of teaching hospital.

TABLE 4-30

MEAN DEPARTMENT-LEVEL PART A COSTS AND TOTAL PART B CHARGES PER ADMISSION, BY HOSPITAL TYPE, FOR COLECTOMY

	ACADEMIC MEDICAL CENTERS (N=2,608)		COTH HOSPITALS (N=5,159)		OTHER TEACHING HOSPITALS (N=6,880)		NON-TEACHING HOSPITALS (N=4,403)	
Hospital Department	MEAN	STD DEV.	MEAN	STD DEV.	MEAN	STD DEV.	MEAN	STD DEV.
Operating Room	$2,164.84 ***	(1,811)	$1,723.71	(1,675.96)	$1,698.85	(2,422.78)	$1,716.54	(4,383.02)
Pharmacy	991.80 ***	(1,820)	990.13 ***	(2,464.11)	1,266.92 *	(4,476.27)	1,477.21	(6,199.87)
Lab	1,904.95 ***	(3,557)	1,422.96 ***	(2,238.06)	1,301.85	(2,917.74)	1,220.62	(4,580.29)
Radiology	601.40 ***	(1,247)	450.82	(852.32)	498.28	(1,443.51)	456.35	(2,028.88)
Medical Supplies	770.99 ***	(1,465)	710.61 ***	(1,178.94)	987.53 ***	(3,194.11)	1,262.64	(4,561.49)
Anesthesiology	284.90 ***	(577)	125.10 ***	(228.61)	220.57	(707.47)	220.64	(905.32)
Inhalation Therapy	449.05	(1,753)	415.76	(1,458.17)	402.56	(1,857.79)	474.63	(3,552.46)
Physical Therapy	112.03 ***	(404)	56.98	(268.50)	61.11	(391.38)	56.25	(821.81)
Speech Pathology	1.34	(20)	2.01 *	(32.20)	1.88	(55.20)	0.60	(43.45)
Outpatient/Emergency Room	25.57	(136)	29.48	(177.21)	20.95	(216.20)	24.41	(375.11)
Other Ancillary Costs	0.54 *	(6)	0.52 *	(12.86)	2.96	(82.72)	2.68	(81.78)
Emergency Room	34.55	(167)	39.14	(153.05)	35.40	(206.33)	33.68	(305.69)
Renal Dialysis	14.60	(237)	8.96	(288.92)	14.50	(462.46)	4.65	(275.45)
Other Reimbursable Costs	161.11	(974)	220.15	(1,047.93)	145.77	(1,037.38)	163.15	(2,382.48)
Clinic	2.58 ***	(20)	1.03 **	(20.35)	4.64 ***	(124.64)	0.30	(11.45)
Routine Accommodation, per diem	6,334.08 ***	(6,126)	5,493.91 ***	(6,958.93)	4,376.67 ***	(9,146.68)	3,683.32	(8,535.12)
ICU cost, per diem	2,471.57 ***	(9,194)	1,792.51	(5,450.42)	1,686.91	(9,468.44)	1,561.03	(11,499.66)
Total Part A Dept. Costs	16,325.89 ***	(19,296)	13,483.79 **	(15,390.50)	12,727.35	(25,626.31)	12,358.71	(32,824.81)
Total Part B Charges	2,589.73 ***	(1,839)	2,685.39 ***	(1,870.49)	2,691.21 **	(3,053.28)	2,887.29	(4,859.03)
Total Part A Dept. Costs + Part B Charges	$18,915.62 ***	(20,310)	$16,169.18	(16,451.94)	$15,418.56	(27,152.80)	$15,246.00	(35,898.81)

(a) indicates no values found.

*Significantly different from non-teaching hospitals at the 10% level.
**Significantly different from non-teaching hospitals at the 5% level.
***Significantly different from non-teaching hospitals at the 1% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

SOURCE: HER calculations using HCFA 1991 MedPAR records.

TABLE 4-31

MEAN DEPARTMENT-LEVEL PART A COSTS AND TOTAL PART B CHARGES PER ADMISSION, BY HOSPITAL TYPE, FOR TOTAL HIP REPLACEMENT

	ACADEMIC MEDICAL CENTERS (N=4,358)		COTH HOSPITALS (N=6,132)		OTHER TEACHING HOSPITALS (N=9,829)		NON-TEACHING HOSPITALS (N=5,415)	
Hospital Department	MEAN	STD DEV.	MEAN	STD DEV.	MEAN	STD DEV.	MEAN	STD DEV.
Operating Room	$2,822.37 ***	(2,733)	$2,579.36	(3,071.04)	$2,553.18	(4,271.21)	$2,495.82	(7,267.03)
Pharmacy	478.46 ***	(833)	370.36 ***	(673.17)	459.96 ***	(1,417.96)	574.78	(2,069.47)
Lab	1,011.91 ***	(1,733)	754.08 *	(1,116.58)	654.23	(1,391.24)	687.87	(1,844.05)
Radiology	388.24 ***	(686)	213.33	(373.29)	233.80	(585.40)	226.45	(886.15)
Medical Supplies	2,360.28 ***	(2,235)	2,219.16 ***	(2,313.37)	2,532.06 **	(3,977.22)	2,780.90	(7,224.83)
Anesthesiology	270.46 ***	(676)	124.37 ***	(207.99)	187.33	(542.95)	177.75	(698.10)
Inhalation Therapy	140.30	(605)	114.77 ***	(408.42)	118.06 ***	(599.51)	174.53	(1,413.70)
Physical Therapy	579.75	(522)	486.45 ***	(420.98)	514.02 ***	(788.90)	580.79	(1,347.77)
Speech Pathology	0.63	(9)	1.30	(18.94)	0.71	(18.60)	0.69	(38.62)
Outpatient/Emergency Room	19.79 ***	(175)	9.47	(145.25)	7.97	(130.97)	7.55	(148.36)
Other Ancillary Costs	4.64 *	(39)	0.79 *	(8.13)	2.00 *	(52.34)	15.33	(470.14)
Emergency Room	14.93	(104)	15.84	(76.86)	17.22	(165.59)	19.48	(205.83)
Renal Dialysis	30.04	(418)	13.39	(251.48)	7.49	(217.62)	5.99	(497.63)
Other Reimbursable Costs	79.57 ***	(290)	125.09 ***	(579.85)	76.97 **	(383.52)	51.09	(728.84)
Clinic	2.43 ***	(26)	0.56 *	(12.45)	0.82 *	(37.59)	0.13	(11.10)
Routine Accommodation, per diem	5,074.08 ***	(5,196)	4,097.75 ***	(4,205.39)	3,475.32 ***	(4,649.02)	3,118.35	(8,664.01)
ICU cost, per diem	573.81 ***	(3,593)	296.80	(1,848.21)	219.63	(2,663.85)	296.91	(3,643.23)
Total Part A Dept. Costs	13,851.70 ***	(11,590)	11,422.85	(8,007.64)	11,060.77	(11,818.69)	11,214.41	(17,963.09)
Total Part B Charges	2,791.75 ***	(1,464)	2,909.20 **	(1,438.47)	2,753.42 ***	(2,193.79)	3,031.82	(3,312.08)
Total Part A Dept. Costs + and Part B Charges	$16,643.45 ***	(12,354)	$14,332.05	(8,646.06)	$13,814.19	(12,615.28)	$14,246.23	(19,131.28)

*Significantly different from non-teaching hospitals at the 10% level.
**Significantly different from non-teaching hospitals at the 5% level.
***Significantly different from non-teaching hospitals at the 1% level.

NOTE: All values deflated by the HCFA Wage Index.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

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Laminectomy

Total Part A department costs and Part B charges per admission were significantly higher in academic medical centers ($15,523) compared to non-teaching hospitals ($10,062) for laminectomy (Table 4-32). Much of the difference in the overall total per admission measure is found in higher operating room, lab, and routine and ICU per diem costs in academic medical centers. Unlike other surgical conditions, non-teaching hospitals do not consistently show higher costs in pharmacy, medical supplies, and inhalation therapy (though pharmacy costs and medical supplies are significantly greater versus other COTH hospitals).

TURP

Our final surgical procedure was examined in Table 4-33 where we compared mean per admission Part A department level costs across hospital types. Academic medical centers revealed the highest total Part A plus Part B charges ($7,483), which were significantly greater than non-teaching hospital charges ($6,221). Per diem routine accommodations represented the greatest cost difference between academic medical centers and non-teaching hospitals. Operating room costs were significantly different in all teaching hospital types compared to non-teaching hospitals, with academic medical centers being higher and other COTH and other teaching hospitals being lower. However, the magnitudes of difference were less than $100 per admission. Pharmacy and medical supplies costs again were significantly higher in non-teaching hospitals versus teaching hospitals.

4.5.3 Part A Department Level Costs and Part B Charges: Radiology

In this section, we compare department level costs with Part B charges side by side for radiology. Table 4-34 shows per admission means for the Part A and B components in both levels and percents for each of the ten admission-level conditions and for each hospital type. As mentioned above, this type of comparison may reveal the validity of the "extra testing" hypothesis. In addition, the proportion of Part A and B may indicate substitute or complementary use of inputs in providing radiology services. Although the A and B components are not strictly in the same terms (because

TABLE 4-32

MEAN DEPARTMENT-LEVEL PART A COSTS AND TOTAL PART B CHARGES PER ADMISSION, BY HOSPITAL TYPE, FOR LAMINECTOMY

	ACADEMIC MEDICAL CENTERS (N=2,562)		COTH HOSPITALS (N=4,266)		OTHER TEACHING HOSPITALS (N=6,133)		NON-TEACHING HOSPITALS (N=2,868)	
Hospital Department	MEAN	STD DEV.	MEAN	STD DEV.	MEAN	STD DEV.	MEAN	STD DEV.
Operating Room	$2,570.11 ***	(2,573)	$1,672.54	(1,525.08)	$1,640.35	(2,395.55)	$1,614.93	(3,435.26)
Pharmacy	619.43 *	(1,879)	369.65 **	(929.27)	448.18	(1,663.63)	491.87	(2,522.58)
Lab	886.45 ***	(2,693)	488.66	(1,157.33)	426.95	(1,209.78)	441.93	(1,885.13)
Radiology	577.48 ***	(1,072)	340.96 *	(599.86)	408.09	(1,041.39)	398.39	(1,573.16)
Medical Supplies	921.00 ***	(2,633)	473.64 ***	(1,116.60)	595.33	(2,200.92)	658.78	(2,560.08)
Anesthesiology	325.68 ***	(548)	129.20 ***	(218.75)	205.66	(561.48)	189.20	(685.05)
Inhalation Therapy	348.29 ***	(2,948)	109.69	(598.81)	108.36	(1,052.81)	116.50	(1,299.36)
Physical Therapy	236.66	(539)	132.78 ***	(392.34)	160.48 *	(591.91)	211.17	(1,308.12)
Speech Pathology	4.22	(38)	2.22	(41.15)	1.50	(55.25)	1.95	(76.94)
Outpatient/Emergency Room	17.65 *	(100)	19.51 **	(113.44)	18.75 *	(294.45)	9.33	(195.45)
Other Ancillary Costs	3.15	(78)	1.15	(21.92)	5.54	(104.87)	2.65	(89.60)
Emergency Room	11.13	(78)	21.29 ***	(117.17)	10.36	(86.06)	9.17	(127.70)
Renal Dialysis	44.83	(683)	8.20	(224.23)	9.42	(338.09)	19.11	(1,207.23)
Other Reimbursable Costs	131.70 *	(1,009)	96.44	(472.54)	83.14	(477.07)	80.00	(1,089.85)
Clinic	4.42 ***	(40)	0.66	(12.00)	0.53	(16.19)	0.23	(10.85)
Routine Accommodation, per diem	4,172.29 ***	(6,278)	2,925.20 ***	(4,336.02)	2,517.09	(4,258.39)	2,356.44	(5,753.24)
ICU cost, per diem	1,413.67 ***	(9,951)	422.57	(2,904.63)	374.43	(4,057.63)	340.04	(5,379.18)
Total Part A Dept. Costs	12,288.16 ***	(22,154)	7,214.35	(9,645.11)	7,014.17	(13,050.47)	6,941.68	(17,456.24)
Total Part B Charges	3,235.32	(2,648)	3,174.23	(2,422.59)	2,957.33	(3,350.57)	3,120.63	(5,025.23)
Total Part A Dept. Costs + and Part B Charges	$15,523.48 ***	(23,587)	$10,388.58	(10,951.69)	$9,971.50	(14,871.96)	$10,062.31	(20,570.04)

*Significantly different from non-teaching hospitals at the 10% level.
**Significantly different from non-teaching hospitals at the 5% level.
***Significantly different from non-teaching hospitals at the 1% level.

NOTE: All values deflated by the HCFA Wage Index.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

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TABLE 4-33

MEAN DEPARTMENT-LEVEL PART A COSTS AND TOTAL PART B CHARGES PER ADMISSION, BY HOSPITAL TYPE, FOR TURPs

	ACADEMIC MEDICAL CENTERS (N=6,914)		COTH HOSPITALS (N=17,051)		OTHER TEACHING HOSPITALS (N=25,078)		NON-TEACHING HOSPITALS (N=18,502)	
Hospital Department	MEAN	STD DEV.	MEAN	STD DEV.	MEAN	STD DEV.	MEAN	STD DEV.
Operating Room	$1,114.02 ***	(1,005)	$970.97 ***	(1,011.16)	$932.33 ***	(1,420.03)	$1,026.13	(2,442.81)
Pharmacy	268.10 ***	(785)	250.72 ***	(744.08)	293.55 ***	(1,077.42)	351.07	(1,805.49)
Lab	553.93 ***	(1,338)	494.70 *	(1,083.38)	432.51	(1,213.38)	451.66	(2,349.01)
Radiology	175.46	(467)	158.34	(452.27)	171.14	(670.10)	169.72	(1,053.45)
Medical Supplies	237.72 ***	(684)	235.80 ***	(503.66)	312.80 ***	(995.66)	400.80	(1,694.65)
Anesthesiology	140.20 ***	(261)	67.79 ***	(130.93)	118.58 ***	(341.99)	102.99	(472.26)
Inhalation Therapy	65.16	(650)	64.36 *	(419.95)	63.99 *	(608.94)	81.52	(1,150.91)
Physical Therapy	49.09 ***	(473)	37.65	(351.18)	32.94	(370.23)	30.11	(723.19)
Speech Pathology	3.33 *	(76)	2.62 *	(60.34)	1.79	(60.50)	0.78	(102.11)
Outpatient/Emergency Room	17.34	(89)	19.60 ***	(122.27)	24.48 *	(318.77)	16.18	(420.59)
Other Ancillary Costs	0.29	(9)	0.42	(24.32)	0.65	(22.55)	0.99	(88.62)
Emergency Room	18.71	(87)	28.78	(127.38)	21.24	(134.01)	18.70	(236.83)
Renal Dialysis	8.11	(188)	8.97 *	(355.86)	4.96	(222.95)	2.78	(347.19)
Other Reimbursable Costs	73.29	(591)	100.18 ***	(657.48)	47.09 *	(380.56)	59.70	(915.11)
Clinic	7.18	(134)	0.45 *	(12.63)	0.62	(21.18)	6.00	(456.64)
Routine Accommodation, per diem	2,950.71 ***	(4,433)	2,902.82 ***	(6,483.83)	2,232.96 ***	(7,097.79)	1,736.21	(5,320.47)
ICU cost, per diem	314.15 ***	(2,180)	231.20	(1,775.25)	207.82	(2,487.78)	197.36	(3,952.06)
Total Part A Dept. Costs	5,996.79 ***	(8,563)	5,575.37 ***	(9,221.51)	4,899.45 **	(11,183.54)	4,652.64	(13,784.36)
Total Part B Charges	1,487.11 ***	(1,196)	1,543.28	(1,270.70)	1,501.55 ***	(1,809.19)	1,568.48	(2,581.17)
Total Part A Dept. Costs + Part B Charges	$7,483.90 ***	(9,322)	$7,118.66 ***	(9,908.40)	$6,401.00	(12,180.65)	$6,221.13	(15,490.95)

*Significantly different from non-teaching hospitals at the 10% level.
**Significantly different from non-teaching hospitals at the 5% level.
***Significantly different from non-teaching hospitals at the 1% level.

NOTE: All values deflated by the HCFA Wage Index.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

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TABLE 4-34

MEAN RADIOLOGY PART A COSTS AND TOTAL PART B CHARGES PER ADMISSION, AND PART A AND B PERCENT OF TOTAL[a], BY HOSPITAL TYPE AND DIAGNOSIS CONDITION

Medical Condition	ACADEMIC MEDICAL CENTERS MEANS Part A	Part B	Total A + B	OTHER COTH HOSPITALS MEANS Part A	Part B	Total A + B	OTHER TEACHING HOSPITALS MEANS Part A	Part B	Total A + B	NON-TEACHING HOSPITALS MEANS Part A	Part B	Total A + B
AMIX	440 ***	411 ***	852 ***	312 ***	342 ***	654 ***	304 ***	336 ***	640 ***	273	256	529
	(599)	(458)	(830)	(492)	(465)	(749)	(744)	(681)	(1,126)	(1,244)	(1,088)	(1,818)
	55% ***	45% ***		55% ***	45% ***		55% ***	45% ***		60%	40%	
	(0.32)	(0.32)		(0.36)	(0.36)		(0.52)	(0.52)		(0.92)	(0.92)	
PNEUMONIA	538 ***	129 ***	668 ***	426 ***	127 ***	553 ***	403 ***	110 ***	513 ***	351	93	445
	(1,104)	(223)	(1,250)	(796)	(222)	(941)	(1,132)	(285)	(1,320)	(1,859)	(460)	(2,182)
	77%	23%		75% ***	25% ***		77% *	23% *		78%	22%	
	(0.19)	(0.19)		(0.22)	(0.22)		(0.28)	(0.28)		(0.52)	(0.52)	
STROKE	755 ***	292 ***	1,047 ***	510 ***	239 ***	749 ***	614	232 ***	846 **	612	203	815
	(841)	(306)	(1,027)	(596)	(280)	(771)	(1,079)	(398)	(1,297)	(1,711)	(629)	(2,052)
	68% ***	32% ***		66% ***	34% ***		71% ***	29% ***		73%	27%	
	(0.23)	(0.23)		(0.26)	(0.26)		(0.34)	(0.34)		(0.61)	(0.61)	
ULCER	348 ***	82 ***	430 ***	251	77 ***	329	288 ***	74 ***	361 ***	254	65	319
	(602)	(132)	(686)	(415)	(137)	(516)	(770)	(206)	(913)	(1,159)	(312)	(1,373)
	79%	21%		76% ***	24% ***		79%	21%		79%	21%	
	(0.20)	(0.20)		(0.24)	(0.24)		(0.29)	(0.29)		(0.57)	(0.57)	
DEHYDRATION	337 ***	79 **	416 ***	288	88 ***	376 **	308 ***	79 **	387 ***	268	70	338
	(538)	(130)	(626)	(516)	(162)	(629)	(811)	(207)	(951)	(1,231)	(344)	(1,464)
	79%	21%		75% ***	25% ***		78%	22%		79%	21%	
	(0.20)	(0.20)		(0.23)	(0.23)		(0.29)	(0.29)		(0.55)	(0.55)	

TABLE 4-34 (continued)

MEAN RADIOLOGY PART A COSTS AND TOTAL PART B CHARGES PER ADMISSION, AND PART A AND B PERCENT OF TOTAL[a], BY HOSPITAL TYPE AND DIAGNOSIS CONDITION

Surgical Condition	ACADEMIC MEDICAL CENTERS MEANS Part A	Part B	Total A + B	OTHER COTH HOSPITALS MEANS Part A	Part B	Total A + B	OTHER TEACHING HOSPITALS MEANS Part A	Part B	Total A + B	NON-TEACHING HOSPITALS MEANS Part A	Part B	Total A + B
CABG	902 ***	582 ***	1,484 ***	646	574 ***	1,220 ***	685 *	599 ***	1,284 **	650	703	1,353
	(1,270)	(598)	(1,611)	(981)	(603)	(1,325)	(1,552)	(823)	(1,961)	(1,743)	(1,308)	(2,517)
	62% ***	38% ***		57% ***	43% ***		56% ***	44% ***		52%	48%	
	(0.26)	(0.26)		(0.29)	(0.29)		(0.41)	(0.41)		(0.59)	(0.59)	
COLECTOMY	601 ***	162 ***	763 ***	451	138 **	589	498	138 **	637	456	121	577
	(1,247)	(304)	(1,471)	(852)	(244)	(1,042)	(1,444)	(365)	(1,690)	(2,029)	(508)	(2,404)
	76%	24%		74% ***	26% ***		76%	24%		77%	23%	
	(0.18)	(0.18)		(0.22)	(0.22)		(0.28)	(0.28)		(0.50)	(0.50)	
TOTAL HIP REPLACEMENT	388 ***	85 ***	474 ***	213	60 **	274	234	54	288	226	52	278
	(686)	(167)	(808)	(373)	(129)	(458)	(585)	(167)	(697)	(886)	(236)	(1,036)
	80%	20%		78% ***	22% ***		81%	19%		80%	20%	
	(0.16)	(0.16)		(0.18)	(0.18)		(0.24)	(0.24)		(0.42)	(0.42)	
LAMINECTOMY	577 ***	143 ***	720 ***	341 *	114	455	408	126	534	398	114	513
	(1,072)	(251)	(1,238)	(600)	(216)	(753)	(1,041)	(327)	(1,272)	(1,573)	(515)	(1,954)
	79%	21%		79% *	21% *		79%	21%		81%	19%	
	(0.19)	(0.19)		(0.21)	(0.21)		(0.28)	(0.28)		(0.45)	(0.45)	
TURP	175	57 ***	233	158	54 ***	213	171	53 ***	224	170	44	214
	(467)	(172)	(587)	(452)	(156)	(559)	(670)	(226)	(829)	(1,053)	(319)	(1,284)
	78% ***	22% ***		77% ***	23% ***		81% ***	19% ***		83%	17%	
	(0.23)	(0.23)		(0.27)	(0.27)		(0.32)	(0.32)		(0.56)	(0.56)	

***Significant from non-teaching hospitals at the 1% level.
** Significant from non-teaching hospitals at the 5% level.
*Significant from non-teaching hospitals at the 10% level.
[a]Percentages represent Part A department level cost percents and Part B charge percents of Part A and B combined.
NOTE: All values deflated by the HCFA Wage Index.
SOURCE: HER calculations using HCFA 1991 MedPAR records.

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the A component is a derived cost allocation and the B component is allowed charges), comparisons and aggregations may still be useful as indicators of relative resource use.

Medical Conditions

Among the five medical conditions, teaching hospitals have both significantly higher Part A costs and high Part B charges for radiology services than non-teaching hospitals. All three types of teaching hospitals also have significantly higher combined A-B than non-teaching hospitals. While the proportion of Part A costs varies inconsistently among hospital types, the proportion of Part B radiology charges are highest in other COTH facilities for each condition. Regarding the relative costliness of each condition, stroke patients incur the highest average radiology costs and charges while ulcers and dehydration are the lowest cost conditions.

Surgical Procedures

Our analysis of five surgical procedures indicates that mean Part A costs vary consistently by hospital, with academic medical centers having the highest costs, then other teaching hospitals, followed by non-teaching hospitals, and finally, other COTH hospitals, which have the lowest costs. Few of the differences in Part A costs, however, are significant. In three of the five procedures, Part B mean charges decline as teaching intensity decreases, a result which is similar to the medical conditions. For CABG and laminectomy procedures, however, Part B average charges do not vary consistently among hospital types. For Total A and B, academic medical centers generally have significantly higher combined costs and charges than non-teaching hospitals, while these costs vary among other teaching hospitals.

The proportion of Part A costs does not vary consistently by hospital across procedures. Part B proportions are significantly higher for each procedure for other COTH hospitals but proportions for AMCs and other teaching hospitals do not differ significantly from non-teaching hospitals. The relative costliness of the procedures varies dramatically. CABG patients are the most expensive to treat, while TURP surgeries are the least expensive.

Conclusions

Overall, we found that teaching hospitals tend to have higher Part A costs and Part B charges for radiology services than non-teaching hospitals. When A and B were combined, other COTH and other teaching hospitals were not statistically different from nonteaching hospitals for four of the five surgical procedures (CABG was statistically higher for nonteaching hospitals). AMCs were statistically greater than nonteaching hospitals for all medical conditions and all surgical procedures except for TURP.

The "Extra Testing" Hypothesis

We could not determine the extent of extra testing by residents directly from this analysis, though some indirect evidence may exist. If it is assumed that higher Part A radiology costs reflect additional tests (in terms of the technical component), then higher Part A radiology costs found in teaching facilities, and particularly in AMCs, may signal additional testing done on their medical and surgical patients.

Substitute v. Complementary Use of Inputs

Our findings do not support the hypothesis that resident care is substituting for physician care. If residents did substitute for physicians, Part B charges in teaching hospitals would be lower than in non-teaching hospitals. Our results indicate that for most procedures, the opposite is true. It appears then, that in teaching hospitals, if residents are conducting radiology tests the attending physician is billing Part B for supervising such tests. Other COTH facilities have the highest proportion of Part B charges, which indicates that the least amount of resident-physician substitution is taking place at these hospitals.

4.6 Multivariate Analysis

4.6.1 Empirical Specification and Estimation

Table 4-35 provides a list of all regression variables and corresponding definitions. Tables 4-36 and 4-37 provide means and standard deviations for the regression variables for the five medical conditions and surgical procedures, respectively.

Dependent Variables

Three separate payment models were estimated using the individual admission as the unit of analysis for each of the ten conditions (5 medical and 5 surgical). The first payment model uses the admission's total Part B charges; the second uses total Part B charges plus DME per admission; and the third combines the total Part B charges, DME per admission, and PPS payments per admission. As done in the hospital multivariate analyses, all payment models are deflated by the PPS Wage Index. The models all hold constant more casemix factors (within a relatively homogenous set of observations) than do the hospital regression models, thus enabling a more rigorous test of our hypothesis that Part B bills will be lower per admission in teaching hospitals compared to nonteaching hospitals. Adding in DME payments per admission should provide a comprehensive measure of physician activity per admission and should, theoretically, offset (presumed) lower Part B bills for admissions in teaching hospitals.

DME payments per admission were calculated using hospital-level data from HCRIS PPS-7. We first inflated the DME payments to PPS-8 by the urban CPI (to convert the dollars into the same year as the MedPAR file). We then allocated the hospital level DME total to each admission record by multiplying the DME-per-Medicare-day amount by the admission's length of stay. Thus, admissions with longer stays are allocated a greater share of DME payments than are shorter stay admissions.[3] We do not combine IME payments per admission with Part B charges and DME payments, unlike the hospital multivariate analyses, because high percentages of records at the admission level did not have IME payments reported. In our hospital

[3] This allocation method assumes that longer stay patients are more severe and therefore receive more physician services.

TABLE 4-35

VARIABLE DEFINITIONS FOR ADMISSION LEVEL REGRESSIONS

VARIABLE NAME	VARIABLE DEFINITION
Dependent Variables	
B/ADM	Part B allowed charges per admission
BDME/ADM	Part B plus DME per admission
MCR/ADM	Total Medicare payments per admission
Independent Variables	
AMC	Dummy variable = 1 if hospital is an academic medical center
OCOTH	Dummy variable = 1 if hospital is other COTH
OTEACH	Dummy variable = 1 if hospital is other teaching
AMC*IRB	Interaction of AMC and resident-bed ratio
OCOTH*IRB	Interaction of OCOTH and resident-bed ratio
OTEACH*IRB	Interaction of OTEACH and resident-bed ratio
URBAN	Dummy variable = 1 for hospital urban location
PROFIT	Dummy variable = 1 if hospital is proprietary
GOVT	Dummy variable = 1 if hospital is government-owned (non-federal)
PCTHMO	Proportion of admissions that are HMO enrollees
IM	Dummy variable = 1 if hospital has residency program in internal medicine
CAR	Dummy variable = 1 if hospital has residency program in cardiology
GAS	Dummy variable = 1 if hospital has residency program in gastroenterology
GS	Dummy variable = 1 if hospital has residency program in general surgery
ORTHO	Dummy variable = 1 if hospital has residency program in orthopedic surgery

TABLE 4-35 (continued)

VARIABLE DEFINITIONS FOR ADMISSION LEVEL REGRESSIONS

VARIABLE NAME	VARIABLE DEFINITION
URO	Dummy variable = 1 if hospital has residency program in urology
CTS	Dummy variable = 1 if hospital has residency program in cardiovascular/thoracic surgery
TRANSFER	Dummy variable = 1 if patient was transferred in from other acute care hospital
DISABLED	Dummy variable = 1 if patient is eligible for disability or ESRD benefits
AGE	Patient age
MALE	Dummy variable = 1 if sex is male
WHITE	Dummy variable = 1 if race is white
OUTLIER	Dummy variable = 1 if patient is an outlier case
CC1	Dummy variable = 1 if cancer is present
CC2	Dummy variable = 1 if metastatic cancer is present
CC3	Dummy variable = 1 if AIDS is present
CC4	Dummy variable = 1 if chronic pulmonary disease is present
CC5	Dummy variable = 1 if coronary artery disease is present
CC6	Dummy variable = 1 if congestive heart failure is present
CC7	Dummy variable = 1 if peripheral vascular disease is present
CC8	Dummy variable = 1 if severe chronic liver disease is present
CC9	Dummy variable = 1 if diabetes with end organ damage is present
CC10	Dummy variable = 1 if chronic renal failure is present
CC11	Dummy variable = 1 if nutritional deficiencies are present
CC12	Dummy variable = 1 if dementia is present
CC13	Dummy variable = 1 if functional impairment is present

TABLE 4-36

REGRESSION VARIABLE MEANS: MEDICAL CONDITIONS

	MEDICALLY TREATED AMI		PNEUMONIA		STROKE		BLEEDING ULCERS		DEHYDRATION	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Variables										
Part B Charges	987.05	(1749.04)	860.22	(2405.74)	908.11	(1652.58)	583.57	(1296.61)	614.73	(1399.15)
Part B Charges + DME	1112.39	(1991.64)	1036.07	(2942.49)	1100.41	(2240.78)	756.12	(1835.39)	780.54	(1965.92)
Part B Charges + DME + PPS Payments	5638.88	(4572.74)	7615.71	(15782.23)	5772.71	(9539.91)	4344.17	(5062.01)	4126.20	(5615.89)
Hospital Characteristics										
AMC	0.03	(0.34)	0.03	(0.37)	0.04	(0.36)	0.04	(0.39)	0.04	(0.37)
OCOTH	0.08	(0.54)	0.07	(0.52)	0.09	(0.55)	0.09	(0.53)	0.09	(0.55)
OTEACH	0.26	(0.85)	0.23	(0.87)	0.28	(0.84)	0.27	(0.86)	0.27	(0.85)
AMC*IRB	0.01	(0.17)	0.02	(0.19)	0.02	(0.18)	0.02	(0.20)	0.02	(0.19)
OCOTH*IRB	0.02	(0.13)	0.01	(0.13)	0.02	(0.13)	0.02	(0.15)	0.02	(0.14)
OTEACH*IRB	0.02	(0.10)	0.02	(0.11)	0.02	(0.11)	0.03	(0.12)	0.02	(0.11)
URBAN	0.74	(0.85)	0.69	(0.96)	0.77	(0.79)	0.75	(0.84)	0.77	(0.81)
DSH	0.35	(0.92)	0.36	(1.00)	0.37	(0.90)	0.41	(0.95)	0.39	(0.93)
PROFIT	0.11	(0.61)	0.19	(0.81)	0.12	(0.60)	0.14	(0.68)	0.13	(0.64)
GOVT	0.17	(0.72)	0.17	(0.79)	0.17	(0.70)	0.17	(0.72)	0.16	(0.71)
PCTHMO	0.01	(0.11)	0.01	(0.11)	0.01	(0.11)	0.01	(0.10)	0.01	(0.10)
Residency Programs										
Internal Medicine	*****		0.22	(0.87)	0.26	(0.82)	*****		0.27	(0.84)
Cardiology	0.07	(0.50)	*****		*****		*****		*****	
Gastroenterology	*****		*****		*****		0.08	(0.51)	*****	

TABLE 4-36 (continued)

REGRESSION VARIABLE MEANS: MEDICAL CONDITIONS

	MEDICALLY TREATED AMI		PNEUMONIA		STROKE		BLEEDING ULCERS		DEHYDRATION	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Patient Characteristics										
TRANSFER	0.05	(0.40)	0.01	(0.20)	0.02	(0.24)	0.01	(0.14)	0.01	(0.15)
DISABLED	0.07	(0.49)	0.08	(0.56)	0.04	(0.39)	0.07	(0.51)	0.07	(0.48)
AGE	75.14	(17.36)	76.44	(22.95)	77.28	(16.42)	78.17	(22.88)	77.85	(21.65)
MAIL	0.52	(0.97)	0.52	(1.04)	0.42	(0.92)	0.37	(0.93)	0.37	(0.92)
WHITE	0.89	(0.60)	0.88	(0.68)	0.84	(0.69)	0.82	(0.74)	0.81	(0.74)
OUTLIER	0.01	(0.15)	0.02	(0.32)	0.03	(0.29)	0.01	(0.21)	0.02	(0.25)
Patient Chronic Conditions										
CC1	0.01	(0.16)	0.04	(0.43)	0.01	(0.19)	0.02	(0.24)	0.07	(0.49)
CC2	0.01	(0.16)	0.02	(0.32)	0.01	(0.21)	0.03	(0.31)	0.11	(0.60)
CC3	*****		0.00	(0.11)	*****		*****		0.00	(0.10)
CC4	0.13	(0.65)	0.38	(1.01)	0.09	(0.53)	0.09	(0.56)	0.12	(0.62)
CC5	*****		0.10	(0.62)	0.15	(0.66)	0.08	(0.53)	0.08	(0.51)
CC6	0.40	(0.95)	0.23	(0.87)	0.12	(0.60)	0.11	(0.61)	0.10	(0.58)
CC7	0.04	(0.37)	0.02	(0.27)	0.04	(0.37)	0.02	(0.26)	0.02	(0.28)
CC8	*****		0.00	(0.13)	0.00	(0.08)	0.00	(0.13)	0.01	(0.15)
CC9	0.06	(0.48)	0.04	(0.41)	0.07	(0.46)	0.07	(0.50)	0.06	(0.47)
CC10	0.02	(0.26)	0.02	(0.30)	0.01	(0.21)	0.02	(0.28)	0.03	(0.34)
CC11	0.01	(0.14)	0.05	(0.47)	0.02	(0.24)	0.05	(0.42)	0.13	(0.65)
CC12	0.01	(0.21)	0.04	(0.40)	0.04	(0.36)	0.09	(0.55)	0.07	(0.50)
CC13	0.02	(0.25)	0.03	(0.35)	0.23	(0.79)	0.07	(0.49)	0.03	(0.31)

TABLE 4-37

REGRESSION VARIABLE MEANS: SURGICAL PROCEDURES

	CABG SURGERY		COLECTOMY		REPLACEMENT		LAMINECTOMY		TURP	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Variables										
Part B Charges	6343.41	4240.74	2779.83	2934.15	2905.33	2177.47	3069.48	3327.36	1539.60	1781.61
Part B Charges + DME	6862.36	4571.50	3043.82	3296.00	3107.53	2354.98	3252.74	3553.72	1644.25	2021.66
Part B Charges + DME + PPS Payments	29135.95	17379.34	14431.03	12042.17	11786.53	5927.27	8800.74	7512.21	4883.84	5774.35
Hospital Characteristics										
AMC	0.13	0.45	0.04	0.36	0.06	0.40	0.06	0.39	0.03	0.32
OCOTH	0.22	0.55	0.11	0.55	0.10	0.52	0.13	0.53	0.09	0.53
OTEACH	0.41	0.65	0.29	0.81	0.34	0.81	0 37	0.77	0.28	0.83
AMC*IRB	0.06	0.22	0.02	0.18	0.03	0.20	0.03	0.20	0.01	0.15
OCOTH*IRB	0.05	0.13	0.02	0.14	0.02	0.12	0.02	0.11	0.02	0.13
OTEACH*IRB	0.03	0.08	0.02	0.09	0.03	0.09	0.03	0.09	0.02	0.10
URBAN	0.97	0.23	0.81	0.69	0.82	0.66	0.91	0.46	0.80	0.74
DSH	0.45	0.66	0.34	0.84	0.35	0.82	0.41	0.78	0.35	0.88
PROFIT	0.08	0.35	0.10	0.53	0.07	0.45	0.09	0.46	0.11	0.58
GOVT	0.09	0.39	0.13	0.59	0.11	0.54	0.12	0.51	0.13	0.63
PCTHMO	0.01	0.05	0.01	0.11	0.01	0.11	0.01	0.09	0.01	0.11

TABLE 4-37 (continued)

REGRESSION VARIABLE MEANS: SURGICAL PROCEDURES

	CABG SURGERY		COLECTOMY		REPLACEMENT		LAMINECTOMY		TURP	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Residency Programs										
GS	–	–	0.25	0.77	–	–	–	–	–	–
ORTHO	–	–	–	–	0.23	0.72	0.24	0.68	–	–
URO	–	–	–	–	–	–	–	–	–	–
CTS	0.36	0.64	–	–	–	–	–	–	0.10	0.55
Patient Characteristics										
TRANSFER	0.25	0.57	0.01	0.19	0.00	0.12	0.01	0.19	0.01	0.16
DISABLED	0.07	0.35	0.02	0.25	0.06	0.39	0.17	0.60	0.03	0.30
AGE	71.11	8.59	76.08	13.29	73.88	15.11	68.62	15.88	74.65	12.87
MALE	0.66	0.63	0.45	0.88	0.35	0.82	0.48	0.80	1.00	0.02
WHITE	0.92	0.37	0.88	0.58	0.91	0.48	0.89	0.49	0.88	0.60
OUTLIER	0.08	0.36	0.03	0.30	0.01	0.17	0.01	0 16	0.01	0.17
Patient Chronic Conditions										
CC1	0.00	0.08	0.01	0.16	–	–	0.00	0.10	0.01	0.16
CC2	–	–	0.38	0.86	0.01	0.15	0.01	0.14	0.03	0.33
CC4	0.10	0.39	0.10	0.52	0.08	0.47	0.09	0.45	0.13	0.63
CC5	0.63	0.64	0.08	0.49	0.09	0.49	0.09	0.45	0.12	0.60
CC6	0.15	0.48	0.07	0.44	0.04	0.32	0.02	0.21	0.04	0.34
CC7	0.04	0.24	0.02	0.22	0.02	0.22	0.02	0.21	0.02	0.27
CC8	–	–	0.01	0.17	0.00	0.06	0.00	0.06	0.00	0.07
CC9	0.04	0.26	0.02	0.26	0.01	0.20	0.03	0.26	0.02	0.27
CC10	0.01	0.12	0.00	0.11	0.01	0.12	0.00	0.10	0.01	0.15
CC11	0.00	0.06	0.02	0.26	0.00	0.12	0.00	0.07	0.00	0.11
CC12	0.00	0.03	0.01	0.15	0.01	0.18	0.00	0.05	0.01	0.17
CC13	0.01	0.10	0.01	0.15	0.01	0.15	0.03	0.26	0.02	0.24

level analysis, we derived an overall per admission IME measure. Although this measure is reliable on average, it may not be appropriate for specific admissions within our particular medical conditions and surgical procedures; therefore, we did not include IME in our dependent variable for the admission level regressions. However, we included PPS payments, which do include IME payments, in the third dependent variable for completeness and to generate results that could be compared to the hospital regression estimates.

Independent Variables

Explanatory variables fall into two general categories: (1) hospital characteristics, and (2) patient severity measures. The vector of hospital characteristics includes teaching hospital type dummy variables (AMC, OCOTH, and OTEACH), urban/rural status (URBAN), disproportionate share status (DSH), ownership (PROFIT, GOVT), and percent of patients sponsored by HMOs (PCTHMO). AMC, OCOTH and OTEACH dummies were included to test our hypothesis that teaching status negatively affects Part B billing per admission. DSH is included to capture patient severity due to economic effects. URBAN is included to capture any geographic practice pattern variation not controlled for by the PPS Wage Index. Dummy variables PROFIT and GOVT were included to examine the impact of different management styles and community missions vis-a-vis voluntary hospitals. We hypothesize that admissions to GOVT hospitals will have fewer Part B payments because of greater altruism, especially for academic medical center physicians where most have public or voluntary non-profit ownership. PCTHMO is included because HMO-sponsored patients do not generate Part B bills. Teaching variables include the resident-bed ratio (IRB), a measure of teaching intensity, interacted with each teaching hospital dummy variable; and residency program dummy variables relevant to each specific condition. The IRB was interacted with the hospital type dummies because we hypothesized that the marginal affect of IRB on Part B billing varied by type of teaching hospital. We include residency program dummy variables relevant to each condition because we hypothesize that the presence of a residency program (in the hospital where the patient is treated) for a specialty more likely to perform services for each respective condition will involve more care by residents and, hence, fewer Part B bills.

Patient characteristic variables, or case severity measures, include a disabled/ESRD Medicare eligibility dummy variable (DISABLED), patient age (AGE), patient sex (MALE), a patient race dummy variable (WHITE), a patient outlier status dummy (OUTLIER), and 13 chronic condition dummy variables (see Table 4-35). DISABLED is included to measure severity and complexity of these patients. We hypothesize that DISABLED would be positively correlated to Part B payments, *ceteris paribus*. AGE is hypothesized to capture greater severity of older patients while MALE is included to control for gender differences in severity of illness. WHITE (black and other races combined are the excluded category) is included to capture economic and cultural influences on severity and utilization that are correlated with race. We expect OUTLIER to be positively correlated with Part B bills. Outlier patients by definition are classified as more severe and would be expected to receive far greater amounts of service than average. Finally, the chronic conditions are included to capture patient specific severity as these chronic conditions are correlated with medical and surgical complications. The expected impact from the chronic conditions on Part B charges is ambiguous. The presence of a chronic condition could require additional services which would lead to higher Part B payments, or chronic conditions could lead to complications such as death which would limit Part B charges.

Estimation

Approximately 6 to 10 percent of our admissions across conditions had zero total Part B payments. We predicted that dropping these records would bias our results and therefore we chose to retain them. The sample distribution of payments is highly skewed which normally requires logging the variable. Because we elected to retain our zero-valued observations, we were unable to apply the natural log transformation for this dependent variable. However, we were concerned about extreme outliers skewing our estimates so we employed a standard data editing technique whereby the top 1 percent of the sample was assigned the median value of this top 1 percent subset.[4] We then were able to estimate the regression equations in linear form.

[4] See Manning, *et al.*, (1987) for an example of this technique used in the RAND Health Insurance Experiment.

4.6.2 Regression Results

Table 4-38 contains parameter estimates for the Part B payment model for the five medical conditions while Table 4-39 contains similar information for the five surgical procedures. The Part B plus DME models for medical conditions and surgical procedures are found in Tables 4-40 and 4-41, respectively. Regression results for the final model, total Medicare payments, for medical conditions and surgical procedures are listed in Tables 4-42 and 4-43. We summarize the marginal impacts of teaching status and teaching intensity for all ten conditions and procedures, by the three payment models, in Table 4-44.

4.6.2.1 Part B Payment Model: Medical Conditions

Across the five medical conditions, most of the hospital characteristics have the expected sign. Patients treated in urban hospitals always have greater Part B charges than those in rural hospitals, even after controlling for geographic price differences. Disproportionate share status and public ownership of the hospital always show statistically lower Part B bills for patients in our five medical conditions. One reason for this finding may be that physicians do not bill Part B for indigent patients found more frequently in these hospitals. Patients treated in for-profit hospitals for AMI and stroke had significantly higher Part B charges compared to similar patients in voluntary hospitals, while pneumonia, ulcer, and dehydration patients in for-profit hospitals had significantly fewer Part B charges (versus voluntary hospitals). The parameter estimates for HMO enrollees are always significantly negative, as expected. Among the patient characteristics, transfer patients and outlier patients were always found to be associated with higher Part B payments than non-transfer and non-outlier patients. More Part B bills were for whites and males than females and non-whites. Surprisingly, patient age and disability status were always correlated with fewer Part B bills. The presence of chronic conditions usually resulted in statistically significant effects on Part B charges. Not surprisingly, the signs on these coefficients varied in sign, both within a medical condition and across the five medical conditions.

TABLE 4-38

ADMISSION LEVEL REGRESSION RESULTS FOR THE PART B PLUS DME PAYMENT MODEL: MEDICAL CONDITIONS

Variables	MEDICALLY-TREATED AMI Parameter Estimate	PNEUMONIA Parameter Estimate	STROKE Parameter Estimate	BLEEDING ULCER Parameter Estimate	DEHYDRATION Parameter Estimate
Hospital Characteristics					
AMC	-36.36	-122.42	55.68	53.34	111.96 *
OCOTH	-7.47	10.55	33.35	64.72 ***	116.73 ***
OTEACH	-1.65	-52.51 ***	9.94	3.46	27.16 **
AMC*IRB	45.26	-72.98	-178.55 *	-243.88 **	-358.61 ***
OCOTH*IRB	-111.43	-81.98	-198.68 ***	-227.85 ***	-262.13 ***
OTEACH*IRB	-125.80	-41.14	-330.41 ***	153.94 **	-115.77
URBAN	254.10 ***	327.49 ***	245.76 ***	141.43 ***	102.08 ***
DSH	-39.61 ***	-25.87 **	-27.28 ***	-26.47 ***	-14.24 *
PROFIT	85.91 ***	-12.32	51.61 ***	-33.71 ***	-12.02
GOVT	-130.93 ***	-118.59 ***	-117.18 ***	-103.88 ***	-93.92 ***
PCTHMO	-1347.55 ***	-939.17 ***	-1322.13 ***	-828.71 ***	-812.92 ***
IM	–	-1.23	65.24 ***	–	24.60 *
CAR	11.14	–	–	–	–
GAS	–	–	–	23.92	–
Patient Characteristics					
OUTLIER	1948.39 ***	3057.22 ***	1464.53 ***	1825.74 ***	1563.00 ***
TRANSFER	176.15 ***	649.03 ***	224.79 ***	266.19 ***	249.50 ***
DISABLED	-272.76 ***	-126.22 ***	-95.24 ***	-63.62 ***	-71.46 ***
AGE	-17.04 ***	-6.42 ***	-7.88 ***	-2.37 ***	-1.70 ***
MALE	29.24 ***	23.23 **	38.48 ***	5.05	12.52 *
WHITE	95.40 ***	-19.49	35.44 ***	-29.22 ***	-9.15
Patient Chronic Conditions					
CC1	87.21 **	60.01 **	174.52 ***	11.07	-36.73 ***
CC2	-153.45 ***	51.44	97.34 ***	92.18 ***	-9.69
CC3	–	-115.75	–	–	-46.40
CC4	-21.12 **	-52.33 ***	30.70 ***	1.13	-6.54
CC5	–	-174.07 ***	-54.50 ***	-85.88 ***	-91.58 ***
CC6	135.92 ***	165.94 ***	156.73 ***	108.34 ***	105.07 ***
CC7	-90.98 ***	-41.63	-3.94	-33.90	-47.58 **
CC8	–	258.93 ***	22.94	29.91	13.16
CC9	26.72 **	48.98 *	65.90 ***	36.57 ***	23.84 *
CC10	13.05	306.71 ***	234.95 ***	160.79 ***	96.39 ***
CC11	81.58 *	160.91 ***	361.59 ***	211.76 ***	226.12 ***
CC12	-188.05 ***	-210.55 ***	-138.14 ***	-96.51 ***	-89.08 ***
CC13	-173.47 ***	-187.14 ***	-54.46 ***	-46.69 ***	-36.01
INTERCEPT	1980.59 ***	1114.95 ***	1264.91 ***	690.51 ***	637.64 ***
ADJ R-SQ	0.09	0.21	0.12	0.13	0.12

***Significant at 1% level.
**Significant at 5% level.
*Significant at 10% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

TABLE 4-39

ADMISSION LEVEL REGRESSION RESULTS FOR THE PART B PAYMENT MODEL:
SURGICAL PROCEDURES

Variables	CABG SURGERY Parameter Estimate	COLECTOMY Parameter Estimate	TOTAL HIP REPLACEMENT Parameter Estimate	LAMINECTOMY Parameter Estimate	TURP Parameter Estimate
Hospital Characteristics					
AMC	-321.66 ***	-200.58	-37.15	-131.34	250.86 ***
OCOTH	-211.86 ***	-159.02 **	37.37	180.20 *	44.27 *
OTEACH	-562.99 ***	-157.46 ***	-180.82 ***	-238.91 ***	-29.31 **
AMC*IRB	-1924.78 ***	-383.67	-470.37 **	595.28	-766.30 ***
OCOTH*IRB	-1509.86 ***	-129.01	-384.07 *	-130.86	-302.16 ***
OTEACH*IRB	1144.90 ***	236.26	245.16	2183.22 ***	-194.08 **
URBAN	-1069.49 ***	-5.47	-219.44 ***	-172.36 ***	-88.43 ***
DSH	130.46 ***	44.72 *	102.63 ***	36.14	12.73
PROFIT	-136.73 ***	236.78 ***	166.38 ***	264.11 ***	76.52 ***
GOVT	280.27 ***	-21.88	87.66 ***	55.91	-63.39 ***
PCTHMO	-7661.83 ***	-4654.13 ***	-3906.85 ***	-3619.52 ***	-2270.11 ***
GS	–	13.72	–	–	–
ORTHO	–	–	-3.35	-148.91 ***	–
URO	–	–	–	–	-6.65
CTS	126.07 ***	–	–	–	–
Patient Characteristics					
OUTLIER	3852.87 ***	3283.15 ***	1374.13 ***	4844.09 ***	2086.40 ***
TRANSFER	279.21 ***	590.97 ***	200.23	641.13 ***	798.21 ***
DISABLED	225.70 ***	341.88 ***	-135.74 ***	241.92 ***	117.94 ***
AGE	31.10 ***	12.43 ***	-4.35 ***	16.27 ***	11.70 ***
MALE	-31.24	50.20 **	67.60 ***	-135.92 ***	-171.08
WHITE	349.12 ***	53.57	355.73 ***	180.84 ***	-83.35 ***
Patient Chronic Conditions					
CC1	699.21 ***	252.60 **	–	794.80 ***	373.18 ***
CC2	–	152.19 ***	391.90 ***	1163.55 ***	460.35 ***
CC3	–	–	–	–	–
CC4	121.14 ***	172.35 ***	95.98 ***	326.51 ***	69.76 ***
CC5	-191.02 ***	-98.93 **	17.51	50.73	-20.59 *
CC6	508.28 ***	582.27 ***	-38.38	1078.52 ***	492.03 ***
CC7	-0.54	-49.89	104.55 *	62.31	55.23 **
CC8	–	110.15	367.35 *	206.06	351.79 ***
CC9	278.68 ***	322.43 ***	-120.04 *	513.04 ***	338.02 ***
CC10	748.74 ***	1193.56 ***	530.49 ***	718.56 ***	407.24 ***
CC11	479.76 **	408.39 ***	-137.24	2171.23 ***	867.32 ***
CC12	427.88	-403.19 ***	-682.90 ***	-918.56 *	102.98 ***
CC13	-11.62	-129.48	-1.46	832.82 ***	-42.88
INTERCEPT	4925.55 ***	1635.70 ***	3116.00 ***	1700.07 ***	941.63 ***
ADJ R-SQ	0.15	0.18	0.08	0.10	0.12

***Significant at 1% level.
**Significant at 5% level.
*Significant at 10% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

TABLE 4-40

ADMISSION LEVEL REGRESSION RESULTS FOR THE PART B PLUS DME PAYMENT MODEL: MEDICAL CONDITIONS

Variables	MEDICALLY-TREATED AMI Parameter Estimate	PNEUMONIA Parameter Estimate	STROKE Parameter Estimate	BLEEDING ULCER Parameter Estimate	DEHYDRATION Parameter Estimate
Hospital Characteristics					
AMC	367.60 ***	642.92 ***	605.30 ***	693.85 ***	661.76 ***
OCOTH	56.20 **	287.89 ***	118.44 ***	251.11 ***	280.60 ***
OTEACH	56.64 ***	34.18	52.49 ***	74.92 ***	77.11 ***
AMC*IRB	968.90 ***	829.21 ***	1069.19 ***	463.25 ***	272.06 *
OCOTH*IRB	1571.12 ***	1800.18 ***	1802.45 ***	1202.84 ***	1098.05 ***
OTEACH*IRB	1599.20 ***	2651.88 ***	1913.70 ***	2018.94 ***	1861.18 ***
URBAN	247.76 ***	301.17 ***	229.82 ***	113.08 ***	76.78 ***
DSH	-18.73 **	10.63	-3.39	16.63 *	18.39 *
PROFIT	82.16 ***	-27.63 *	35.85 ***	-64.10 ***	-26.02 *
GOVT	-153.46 ***	-162.75 ***	-162.39 ***	-164.92 ***	-125.48 ***
PCTHMO	-1505.75 ***	-1172.08 ***	-1557.04 ***	-1043.45 ***	-1050.83 ***
IM	–	-0.78	136.44 ***	–	85.09 ***
CAR	36.07 *	–	–	–	–
GAS	–	–	–	54.12 ***	–
Patient Characteristics					
OUTLIER	2913.33 ***	4101.01 ***	2797.79 ***	3375.73 ***	2958.88 ***
TRANSFER	124.39 ***	682.76 ***	276.04 ***	276.68 ***	280.70 ***
DISABLED	-273.57 ***	-114.93 ***	-99.98 ***	-71.10 ***	-99.09 ***
AGE	-17.03 ***	-5.62 ***	-7.40 ***	-1.57 ***	-0.84
MALE	26.57 ***	29.34 **	35.35 ***	1.14	1.90
WHITE	72.21 ***	-46.96 **	-27.59 ***	-62.87 ***	-56.04 ***
Patient Chronic Conditions					
CC1	94.11 **	63.65 **	220.85 ***	13.23	-48.47 ***
CC2	-128.64 ***	60.84	106.62 ***	113.80 ***	-11.12
CC3	–	-141.48	–	–	-103.58
CC4	-25.01 **	-56.62 ***	29.53 **	-7.75	-13.98
CC5	–	-202.64 ***	-83.29 ***	-117.76 ***	-115.41 ***
CC6	164.75 ***	187.54 ***	182.83 ***	134.43 ***	104.08 ***
CC7	-92.48 ***	-53.75	-27.57	-23.23	-48.84
CC8	–	234.97 **	-12.53	12.22	46.96
CC9	29.00 **	53.94 *	66.64 ***	45.21 ***	36.74 **
CC10	22.44	313.85 ***	247.15 ***	159.60 ***	67.64 ***
CC11	122.93 **	202.52 ***	467.89 ***	286.07 ***	274.78 ***
CC12	-188.65 ***	-236.31 ***	-148.43 ***	-101.70 ***	-96.15 ***
CC13	-181.32 ***	-211.00 ***	-59.41 ***	-53.29 ***	-44.36 *
INTERCEPT	1999.04 ***	1078.19 ***	1282.99 ***	669.82 ***	615.77 ***
ADJ R-SQ	0.15	0.29	0.26	0.28	0.25

***Significant at 1% level.
**Significant at 5% level.
*Significant at 10% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

TABLE 4-41

ADMISSION LEVEL REGRESSION RESULTS FOR THE PART B PLUS DME PAYMENT MODEL: SURGICAL PROCEDURES

Variables	CABG SURGERY Parameter Estimate	COLECTOMY Parameter Estimate	TOTAL HIP REPLACEMENT Parameter Estimate	LAMINECTOMY Parameter Estimate	TURP Parameter Estimate
Hospital Characteristics					
AMC	382.58 ***	1980.81 ***	968.49 ***	898.82 **	1370.62 ***
OCOTH	-85.81	-121.80	206.96 *	-72.87	96.96
OTEACH	-458.14 ***	-85.53	-125.16 **	-350.40 ***	-91.11 ***
AMC*IRB	-64.17 ***	5887.07 ***	5966.29 ***	4512.57 ***	965.36 **
OCOTH*IRB	1754.78 ***	10351.00 ***	7850.52 ***	5837.81 ***	4188.07 ***
OTEACH*IRB	4293.66 ***	12991.00 ***	8092.99 ***	7296.63 ***	4913.47 ***
URBAN	-1006.98 ***	-444.25 ***	-766.34 ***	-436.39 ***	-60.74 **
DSH	128.65 ***	1077.20 ***	653.70 ***	553.11 ***	305.69 ***
PROFIT	-205.38 ***	718.57 ***	49.54	264.88 **	99.31 ***
GOVT	282.00 ***	402.97 ***	322.81 ***	357.57 ***	-83.11 **
PCTHMO	-8049.15 ***	-19811.00 ***	-13397.00 ***	-9370.11 ***	-6239.27 ***
GS	–	-94.35	–	–	–
ORTHO	–	–	-44.09	-118.65	–
URO	–	–	–	–	-120.00 ***
CTS	112.77	–	–	–	–
Patient Characteristics					
OUTLIER	4782.43 ***	19686.00 ***	10699.00 ***	21574.00 ***	10911.00 ***
TRANSFER	276.62 ***	684.23 ***	323.86	809.61 ***	989.98 ***
DISABLED	308.93	1020.80 ***	-327.31 ***	229.38 *	609.99 ***
AGE	37.21 ***	46.07 ***	7.49 ***	42.52 ***	52.13 ***
MALE	-73.03 ***	-65.77	-58.56	-305.19 ***	-2665.43 ***
WHITE	271.10	-517.27 ***	94.87	-146.95	-370.99 ***
Patient Chronic Conditions					
CC1	714.09 *	1339.11 ***	–	2282.10 ***	1241.61 ***
CC2	–	1110.35 ***	984.06 ***	3274.40 ***	1286.31 ***
CC3	–	–	–	–	–
CC4	116.84	855.15 ***	168.10 **	1639.83 ***	621.74 ***
CC5	-252.31 ***	-247.35 *	-71.81	352.49 ***	-163.53 ***
CC6	607.35 ***	1553.23 ***	-73.63	2923.40 ***	1596.08 ***
CC7	-39.60 ***	-199.82	92.63	208.54	-179.24 **
CC8	–	987.89 **	906.21 *	-238.30	1318.62 ***
CC9	318.12 **	1212.07 ***	26.07	1794.01 ***	1533.63 ***
CC10	911.08 ***	207.23	1342.78 ***	2519.65 ***	1573.09 ***
CC11	1170.63 ***	636.28 **	-24.96	5954.53 ***	3459.83 ***
CC12	500.48	-1220.30 ***	-658.88 ***	-1644.54 *	468.12 ***
CC13	-0.31	-200.68	-9.97	1839.73 ***	174.21 **
INTERCEPT	4471.98 ***	9605.40 ***	11041.00 ***	5350.18 ***	3422.15 ***
ADJ R-SQ	0.33	0.36	0.30	0.33	0.23

***Significant at 1% level.
**Significant at 5% level.
*Significant at 10% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

TABLE 4-42

ADMISSION LEVEL REGRESSION RESULTS FOR THE TOTAL MEDICARE PART B PAYMENT MODEL: MEDICAL CONDITIONS

Variables	MEDICALLY-TREATED AMI Parameter Estimate	PNEUMONIA Parameter Estimate	STROKE Parameter Estimate	BLEEDING ULCER Parameter Estimate	DEHYDRATION Parameter Estimate
Hospital Characteristics					
AMC	1430.90 ***	2670.76 ***	1428.64 ***	1307.52 ***	1421.42 ***
OCOTH	234.92 ***	612.74 **	14.21	216.77 ***	452.60 ***
OTEACH	86.30 ***	-117.13	-24.35	65.01 *	115.72 ***
AMC*IRB	3244.03 ***	2670.20 **	3500.37 ***	2376.13 ***	1714.88 ***
OCOTH*IRB	5575.53 ***	10205.00 ***	7563.03 ***	4828.00 ***	4605.62 ***
OTEACH*IRB	6941.57 ***	11544.00 ***	7769.32 ***	5224.59 ***	5706.48 ***
URBAN	257.64 ***	546.94 ***	209.08 ***	10.21	81.65 ***
DSH	258.06 ***	547.98 ***	333.31 ***	302.77 ***	285.27 ***
PROFIT	-112.06 ***	217.72 **	-59.97	-89.56 ***	-83.26 **
GOVT	-180.99 ***	16.18	-182.10 ***	-73.96 **	-28.96
PCTHMO	-6783.38 ***	-6202.45 ***	-6283.40 ***	-4756.22 ***	-4351.86 ***
IM	–	-227.77	-50.28	–	-78.33
CAR	-44.97	–	–	–	–
GAS	–	–	–	-215.38 ***	–
Patient Characteristics					
OUTLIER	8592.98 ***	22070.00 ***	14451.00 ***	11386.00 ***	10769.00 ***
TRANSFER	137.09 ***	2277.10 ***	732.07 ***	612.94 ***	401.74 ***
DISABLED	-51.60	-67.92	-30.01	-21.41	-182.49 ***
AGE	12.41 ***	-8.94 **	-6.57 ***	3.53 ***	1.75
MALE	-36.86 **	71.89	86.94 ***	-29.87	23.26
WHITE	-86.09 ***	-293.10 ***	-449.79 ***	-289.25 ***	-193.20 ***
Patient Chronic Conditions					
CC1	277.77 ***	-44.74	847.11 ***	418.43 ***	77.25
CC2	177.41 *	19.49	213.50	419.12 ***	234.64 ***
CC3	–	-650.58	–	–	1162.77 ***
CC4	126.41 ***	-36.03	69.40	124.16 ***	145.75 ***
CC5	–	-922.41 ***	-462.94 ***	-234.09 ***	-250.87 ***
CC6	1182.60 ***	614.36 ***	536.13 ***	438.36 ***	359.18 ***
CC7	-206.69 ***	-587.54 **	-285.09 ***	-99.54	-271.31 ***
CC8	–	314.03	-303.22	493.76 ***	363.17 **
CC9	220.95 ***	86.54	69.45	292.89 ***	520.00 ***
CC10	202.66 ***	1008.38 ***	488.50 ***	277.75 ***	220.32 ***
CC11	257.65 ***	901.63 ***	812.19 ***	478.75 ***	674.05 ***
CC12	-118.80 *	-1092.69 ***	-412.24 ***	-228.03 ***	-354.52 ***
CC13	-163.31 ***	-624.62 ***	-209.37 ***	-146.33 ***	-206.91 ***
INTERCEPT	3705.63 ***	6903.16 ***	5686.34 ***	3675.82 ***	3302.11 ***
ADJ R-SQ	0.32	0.24	0.26	0.34	0.25

***Significant at 1% level.
**Significant at 5% level.
*Significant at 10% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

TABLE 4-43

ADMISSION LEVEL REGRESSION RESULTS FOR THE TOTAL MEDICARE PART B PAYMENT MODEL: SURGICAL PROCEDURES

Variables	CABG SURGERY Parameter Estimate	COLECTOMY Parameter Estimate	TOTAL HIP REPLACEMENT Parameter Estimate	LAMINECTOMY Parameter Estimate	TURP Parameter Estimate
Hospital Characteristics					
AMC	2987.40 ***	443.33 **	575.85 ***	383.41 *	691.10 ***
OCOTH	-200.57 **	-9.03	210.05 ***	290.66 ***	103.67 ***
OTEACH	-379.05 ***	-52.49	-101.77 ***	-172.90 ***	16.57
AMC*IRB	8440.09	1558.59 ***	571.47 ***	1527.58 ***	-235.33
OCOTH*IRB	16983.00 ***	2688.74 ***	1476.94 ***	1314.26 ***	1068.49 ***
OTEACH*IRB	18596.00 ***	3831.33 ***	2457.08 ***	3814.21 ***	1190.50 ***
URBAN	-2672.27 ***	-10.88	-224.33 ***	-161.58 ***	-93.41 ***
DSH	1592.84 ***	97.69 ***	134.07 ***	50.59	29.59 ***
PROFIT	-850.53 ***	226.95 ***	166.61 ***	266.50 ***	68.74 ***
GOVT	1364.37 ***	-32.45	89.55 ***	73.50	-90.73 ***
PCTHMO	-34911.00 ***	-4962.90 ***	-4127.52 ***	-3854.77 ***	-2432.40 ***
GS	--	-38.52	--	--	--
ORTHO	--	--	-27.48	-162.57 ***	--
URO	--	--	--	--	-16.13
CTS	-513.89 ***	--	--	--	--
Patient Characteristics					
OUTLIER	24340.00 ***	4288.77 ***	2264.24 ***	6366.46 ***	3146.42 ***
TRANSFER	471.70 ***	684.23 ***	323.86 ***	809.61 ***	989.98 ***
DISABLED	122.12 ***	434.93 ***	-113.06 **	262.19 ***	142.55 ***
AGE	141.66 ***	15.20 ***	-2.97 **	21.22 ***	13.65 ***
MALE	-590.80 ***	47.19 **	63.97 ***	-152.76 ***	-212.47
WHITE	-64.31 ***	-36.14	292.67 ***	101.83 **	-121.81 ***
Patient Chronic Conditions					
CC1	1065.37 ***	313.10 **	--	941.68 ***	401.58 ***
CC2	--	171.48 ***	514.81 ***	1363.67 ***	513.29 ***
CC3	--	--	--	--	--
CC4	-125.38 ***	159.16 ***	104.63 ***	341.08 ***	81.00 ***
CC5	-958.87 ***	-131.38 ***	3.82	51.05	-33.34 ***
CC6	1640.56 ***	608.33 ***	-37.75	1096.70 ***	539.51 ***
CC7	-607.90	-35.13	114.75 *	63.61	46.54 *
CC8	--	126.16	474.48 **	292.59	398.57 ***
CC9	451.94 ***	337.17 ***	-92.26	536.63 ***	386.10 ***
CC10	1133.04 ***	1032.49 ***	608.28 ***	794.37 ***	485.83 ***
CC11	10409.00 ***	530.03 ***	-189.08	2299.00 ***	960.04 ***
CC12	314.88	-410.92 ***	-687.15 **	-913.24 **	160.47 ***
CC13	-474.58	-188.07	7.91	947.06 ***	-18.04
INTERCEPT	17858.00 ***	1471.20 ***	3059.20 ***	1537.21 ***	866.15 ***
ADJ R-SQ	0.19	0.25	0.12	0.15	0.17

***Significant at 1% level.
**Significant at 5% level.
*Significant at 10% level.

SOURCE: 1991 Medicare Part A and Part B claims for a sample of hospitals.

TABLE 4-44

MARGINAL IMPACTS ON PART B CHARGES, PART B PLUS DME, AND TOTAL MEDICARE PAYMENTS PER ADMISSION, FROM TEACHING STATUS AND TEACHING INTENSITY

		MARGINAL IMPACTS FROM:			
	Payment Model	AMC	OCOTH	OTEACH	IRB
CONDITION					
Medically-Treated AMI	Part B Charges	-$14.82	-$30.35	-$12.40	-$40.88
	Part B + DME	828.52	378.79	193.29	580.93
	Total Medicare Payments	2,974.14	1,379.73	679.49	2,387.19
Pneumonia	Part B Charges	-157.78	-7.03	-56.38	-17.31
	Part B + DME	1,044.71	674.11	283.60	751.52
	Total Medicare Payments	3,964.60	2,802.20	968.64	3,400.43
Stroke	Part B Charges	-29.49	-8.80	-18.98	-116.75
	Part B + DME	1,115.31	500.83	219.97	735.92
	Total Medicare Payments	3,098.32	1,618.71	655.61	2,977.94
Ulcers	Part B Charges	-64.05	12.23	18.48	11.18
	Part B + DME	916.83	528.21	272.02	673.18
	Total Medicare Payments	2,451.24	1,328.99	575.05	1,943.65
Dehydration	Part B Charges	-62.82	59.28	16.79	-69.27
	Part B + DME	794.36	521.27	243.81	614.74
	Total Medicare Payments	2,257.24	1,462.05	626.84	2,031.71
PROCEDURE					
CABG	Part B Charges	-1,250.40	-578.33	-511.15	-161.42
	Part B + DME	335.91	246.40	-150.02	2,113.46
	Total Medicare Payments	6,530.80	3,233.19	1,065.64	12,369.55
Colectomy	Part B Charges	-382.39	-186.99	-138.43	37.96
	Part B + DME	1,181.94	573.80	256.19	1,464.74
	Total Medicare Payments	4,770.69	2,121.97	961.13	5,124.82
Total Hip Replacement	Part B Charges	-264.54	-39.74	-161.93	16.68
	Part B + DME	852.13	506.58	87.52	1,014.24
	Total Medicare Payments	3,852.86	1,783.11	498.30	3,880.30
Laminectomy	Part B Charges	152.69	156.43	-60.95	818.58
	Part B + DME	1,112.28	529.37	138.02	1,659.90
	Total Medicare Payments	3,051.95	987.45	244.38	3,704.90
TURP	Part B Charges	-100.23	-18.11	-45.68	-105.65
	Part B + DME	583.29	324.25	116.98	428.46
	Total Medicare Payments	1,812.91	961.54	323.30	1,805.88

SOURCE: HER calculations from admission level regression model estimates. Data sources include 1991 MedPAR records, PPS-7 HCRIS, and 1991 IRIS data.

Below we discuss some important or unusual findings for each individual medical condition regression.

Medically Treated AMIs

Teaching status and intensity did not have statistically significant effects on Part B payments, though the signs were mostly negative. Patients treated in hospitals with a cardiology residency program did not reveal significantly lower Part B charges than in hospitals without such programs, suggesting that residents may not be substituting for physicians for this condition.

Pneumonia

Among teaching hospitals, only patients treated in other teaching hospitals show significantly fewer Part B bills versus nonteaching hospitals (see Table 4-44 for the overall marginal effect from teaching status on Part B bills). The interaction terms were all negative and insignificant, thus for pneumonia cases within a given type of teaching hospital greater resident availability is not statistically correlated with fewer Part B bills per admission. The presence of an internal medicine residency program in the hospital does not significantly affect Part B charges per admission relative to hospitals without these programs.

Acute Stroke (Cerebral Infarction)

The interaction terms in the stroke admission regression are negative and statistically significant. Thus, greater resident totals within a given type of teaching hospital lead to fewer Part B bills versus nonteaching hospitals. However, we do find a significant positive impact from the presence of an internal medicine residency program in the hospital where stroke patients are treated. This finding suggests that greater availability of residents more likely to be treating stroke patients yields more Part B billing per admission, holding the total number of residents in the hospital constant. That is, while more residents *in toto* at the hospital are correlated with lower Part B charges per stroke admission, the independent effect from having internal medicine residents on Part B charges per stroke admission is positive. This finding may suggest

that internal medicine residents are performing more services that are being billed while other types of residents usually perform services that are not.

Bleeding Ulcers

The dummy variable coefficient on OCOTH hospitals is positive and statistically significant compared to nonteaching hospitals. Interacting IRB with OCOTH produces a statistically negative coefficient which indicates that within other COTH hospitals, having more residents available results in fewer Part B bills for ulcer patients compared to similar patients in hospitals without such programs. A similar result occurs for academic medical centers. In contrast, the interaction term between IRB and OTEACH is positive and significant. So, within OTEACH, having more residents is correlated with higher Part B charges versus nonteaching hospitals. The presence of a gastroenterology residency in teaching hospitals did not result in significantly different Part B charges per admission from those for patients treated in nonteaching hospitals.

Dehydration

The impact of teaching status, holding all other hospital and patient characteristics constant, on Part B bills per admission is positive and significant for our three teaching hospital types. However, interacting IRB with the teaching type dummies yields significantly negative coefficients (except for other teaching hospitals). Having more residents available in the hospital tends to reduce Part B bills per admission within teaching hospital type. We do, however, find a significant and positive effect on Part B bills per admission from the presence of an internal medicine residency program, though the coefficient is small compared to the interaction terms.

4.6.2.2 Part B Payment Model: Surgical Procedures

Regression results for the Part B payment model for all five surgical procedures are presented in Table 4-39. Across these conditions, the AMC dummy is significant for two procedures (once negative and once positive), the OCOTH dummy is significant in four of five procedures (twice negative and twice positive), and the OTEACH dummy is consistently negative and significant. Patients treated in urban hospitals consistently

have fewer Part B bills versus those treated in rural hospitals. For-profit and disproportionate share hospital admissions generally have greater Part B charges. Patient age, race, and transfer, outlier, and disability status consistently are associated with greater Part B charges per admission, *ceteris paribus*, for the five surgical procedures.

Findings from the individual surgical procedures regressions are discussed below.

CABG Surgery

The direct effects of teaching status on Part B bills per admission are strongly negative and significant. Holding all other hospital characteristics and patient severity measures constant, CABG surgery patients in AMCs and other teaching hospitals have lower Part B bills per admission compared to those for comparable patients in nonteaching hospitals. Interacting IRB with the teaching hospital dummies shows a large negative and significant effect on Part B bills per admission for AMCs and OCOTH hospitals. The effect for OTEACH hospitals is positive and significant, indicating that greater resident availability within OTEACH hospitals results in more Part B charges per admission. Surprisingly, Part B bills per admission are significantly lower in for-profit hospitals vis-a-vis non-profits. We also find that the presence of a cardiovascular/thoracic surgery residency program has a positive and significant effect on Part B charges per admission, which may indicate that more services are being performed by residents and billed by physicians.

Colectomy for Patients with Colon Cancer

Teaching hospital dummies show negative coefficients (significant for OCOTH and OTEACH) while the AMC and OCOTH dummies interacted with IRB are both negative and insignificant.

Total Hip Replacement

Among the teaching hospital dummies, only OCOTH is statistically significant (and is negative). However, AMC and OCOTH interacted with IRB both are statistically significant and negative, which implies that within these teaching hospital

types greater resident availability reduces Part B bills per admission versus nonteaching hospitals. Similar to CABG patients, total hip replacements done in government controlled hospitals have higher associated Part B charges per admission.

Laminectomy

The OTEACH dummy coefficient is significant and negative; however, when interacted with IRB the coefficient is positive and strongly significant. As the number of residents increases within other teaching hospitals, Part B bills per admission rise. Focusing on just those residents more likely to treat laminectomy patients, we find that the presence of an orthopedic surgery residency program has a significant negative effect on Part B bills per admission, holding constant hospital and severity indicators.

TURP

The independent influence of the AMC and OCOTH dummies, holding hospital and patient characteristics constant, is positive and significant on Part B bills per admission. Interacting IRB with AMC and OCOTH yields a strongly significant negative effect from the number of residents within these hospital types. Other teaching hospitals have a negative impact on Part B bills per admission as both OCOTH and OTEACH interacted with IRB are negative and significant.

4.6.2.2 Part B Plus DME Model

The dependent variable for this model was created by summing the total Part B charges and DME payments per admission. This variable should be a composite measure of teaching physician activity and be more comparable to nonteaching physician payments.

Table 4-40 provides parameter estimates for the five medical conditions. Adding DME payments to Part B charges yields positive and significant coefficients for the teaching dummies in nearly every instance. In addition, all teaching dummies interacted with IRB show positively significant parameter estimates across all conditions. The reversal in signs after adding DME to Part B charges suggests that DME payments more than offset lower Part B charges per admission (where such cases

were found). Within each type of teaching hospital, greater numbers of residents generate greater total physician payments per admission, as measured by DME and Part B charges, compared to nonteaching hospitals. This result is not surprising since nonteaching hospitals do not receive DME payments. Adding DME to the dependent variable causes all specialty dummy variables to be positive and significant except for the internal medicine residency dummy for pneumonia cases.

Parameter estimates for surgical conditions for the Part B plus DME model are shown in Table 4-41. Similar to medical conditions, adding in DME causes the hospital type dummies to become positive and significant in nearly all instances. Only the parameter estimates for OCOTH for CABG surgery and colectomy are negative, and in both these cases the magnitude was greatly reduced from their Part B payment model values. Likewise, the hospital type dummies interacted with IRB are mostly positive and significant, thus DME payments are again offsetting lower Part B bills in teaching hospitals. (This result is confirmed by the marginal impact estimates in Table 4-44.) The effect on the residency program dummies is very minor from the addition of DME.

4.6.2.3 Total Medicare Payment Model

Adding PPS payments to Part B charges and DME payments produces a summary measure of Medicare payments per admission at teaching hospitals. Parameter estimates therefore capture the marginal effects on Medicare teaching physician payments and facility payments. Tables 4-42 and 4-43 provide parameter estimates for the medical conditions and surgical procedures, respectively.

The effect of teaching status on total Medicare payments is significantly positive when evaluating the hospital dummies and interaction terms. Thus, holding hospital characteristics and patient severity indicators constant, all teaching hospitals have greater total Medicare payments per admission than nonteaching hospitals. The effect of for-profit status changes from positive to negative for AMI patients when analyzing the total Medicare bill. Also, the residency dummy variables decline markedly for all medical conditions, though only the gastroenterology residency program dummy for ulcer patients is statistically significant.

The addition of PPS payments does not cause all teaching hospital dummy coefficients to become positive. The effect on AMC is positive as the magnitude of the estimate increases from the previous models. The effects are opposite for OCOTH and OTEACH as the parameter estimates become smaller when PPS payments are added to the dependent variable. OCOTH is negative for all conditions except TURP, though significant for only total hip replacement. OTEACH, however, shows negative and significant parameter estimates for all conditions except colectomy. Interacting IRB with the teaching dummies produces significantly positive coefficients. Finally, the specialty dummies all fall in size and statistical significance.

4.6.3 Conclusions

We estimated three payment models using five medical condition admission samples and five surgical procedure admission samples. The analysis at the admission level provides us with a much richer set of patient severity and casemix measures compared to the hospital level analysis. Holding constant these additional patient-specific indicators within relatively homogenous groups allows us to better isolate the impacts from teaching on Medicare payments per admission (i.e., Part B charges, DME payments, and total Medicare payments).

The parameter estimates clearly indicate that teaching has an overall negative influence on Part B billing versus nonteaching hospitals. Within type of teaching hospital, the effects of greater resident availability on Medicare payments are generally positive and largest in AMCs, followed by OCOTH and OTEACH.

Table 4-44 shows the marginal effects on the three payment measures from teaching hospital type and teaching intensity (measured by IRB), by all ten conditions. The results generally confirm the analytic conclusions regarding teaching.[5] For instance, the marginal effects from AMC on Part B charges are negative for all medical conditions and four of the surgical conditions. The magnitudes across conditions are generally greatest in AMCs. For medical conditions, these effects range from -$158 per

[5] The marginal effects were calculated using parameter estimates from Tables 4-38 through 4-43, and sample means of relevant variables. The significance of these estimates therefore depends on the significance of the regression parameter estimates.

admission for pneumonia to -$15 per admission for AMI, compared to the nonteaching category. Excluding laminectomy, which is positive, the marginal effect from AMC across surgical procedures ranges from -$100 per admission for TURP to -$1,209 per admission for CABG surgery, compared to the nonteaching category.

When looking at the marginal effects of OCOTH and OTEACH on the Medicare payment variables, no consistent ranking can be made between the two teaching types as the magnitudes vary across conditions. However, both OCOTH and OTEACH generally show marginal effects that are negative for Part B payments per admission (versus nonteaching).

The marginal effect of teaching intensity--measured by IRB--is negative in four of five medical conditions, but is positive in three of five surgical procedures. So, an increase in the IRB of one percentage point reduces Part B charges per admission by $41 for AMI, $117 for stroke, and $116 for CABG. A one percentage point change in the IRB will raise total Part B charges per admission in laminectomy by $819, and by $38 for colectomy.

Moving to the other two Medicare payment measures (Part B plus DME and total Medicare payments), we see a consistent pattern where marginal impacts of teaching type and intensity are increasing in magnitude. For every teaching hospital type (and IRB) for all ten conditions, the magnitude of the marginal effects increases as we move from Part B charges to total Medicare payments. To illustrate this, see AMC where the marginal effect per admission on AMI goes from -$15 for Part B charges to $829 for Part B plus DME, to $2,974 for total Medicare payments. Increasing IRB by one percentage point for AMI shows a decline of $41 per admission for Part B charges, an increase in Part B plus DME of $581 per admission, and an increase in total Medicare payments of $2,387 per admission.

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